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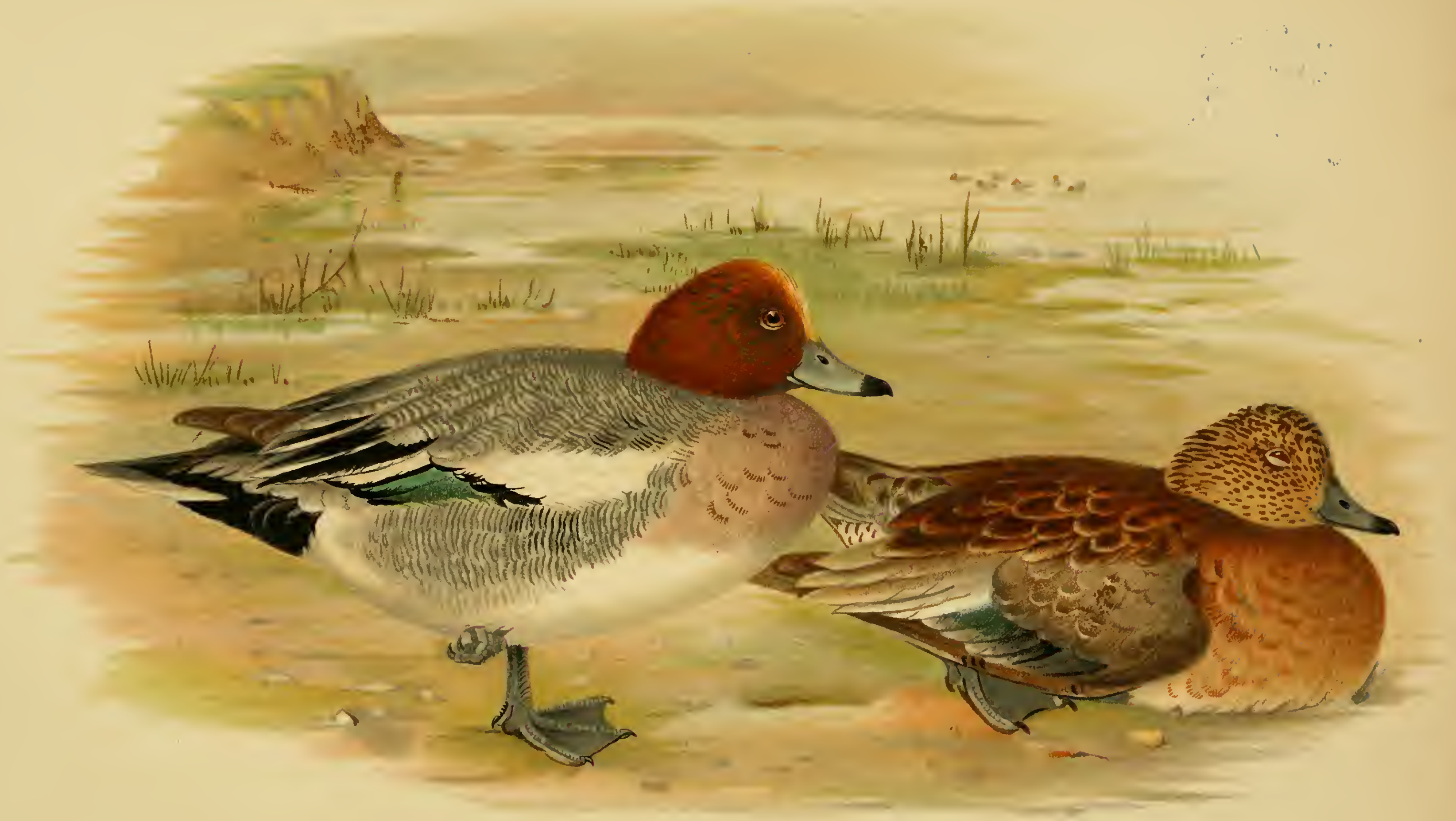

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THE WIGEON.
Mareca penelope.

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Vol. XVI. BOMBAY. No. 1.

THE BIRDS OF TRAVANCORE.

By H. S. Fergusson, F.L.S.

WITH NOTES ON THEIR NIDIFICATION.

By T. F. Bourdillon, F.L.S.

Part III.

(Continued from page 673, *Vol. XV.)*

Order COLUMBÆ.

Family Columbidæ.

Sub-family *Treroninæ*.

(234) Osmotreron affinis.—The Grey-fronted Green Pigeon.

Blanford, No. 1274 ; *Jerdon, No.* 775.

This pigeon is common in forest both in the low country and on the hills at low elevations. In the hot months it ascends them up to 3,000 feet. "I once obtained the nest of the Malabar Green Pigeon at an elevation of 2,400 feet above sea level. I noticed the bird building or I should never have discovered the nest, which was placed in a bushy tree at a height of 40 feet from the ground. It contained only one egg. The nest was a mere platform of loose sticks six inches in diameter. This was in February. The size of the egg, which was, of course, pure white and glossless, was 1·10 × ·85.—*T. F. B.*"

(235) Osmotreron bicincta.—The Orange-breasted Green Pigeon.

Blanford, No. 1278 ; *Jerdon, No.* 774.

This is by no means so common as the last, but may be met with in the low country in forest not far from the coast.

Sub-family *Carpophaginæ.*

(236) CARPOPHAGA ÆNEA.—The Green Imperial Pigeon.

Blanford, No. 1284 ; *Jerdon, No.* 780.

This fine pigeon is only found in forest in the low country. I have never met with it away from the coast, nor have I seen it about the hills.

(237) DUCULA CUPREA.—Jerdon's Imperial Pigeon.

Blanford, No. 1288 ; *Jerdon, No.* 781 (*partim.*)

Unlike the last, this bird is only found in the hills, where it is common in heavy forest at all elevations. "It has two broods in the year, but only lays one egg at a time. These two breeding seasons are in April and again in November. I have seen a bird building in the latter month, and have had the young bird brought to me in January. The nest is a loose structure of twigs without any lining, and exactly resembling an English Wood Pigeon's. I was so fortunate as to find a nest at an elevation of 4,000 feet above sea level and twenty feet from the ground, placed in a mass of tangled irul (*Beesha travancorica*). The bird was sitting and returned to look at the nest, so we had a full view of her. Besides this I have had an egg sent me which had been taken at an equally high elevation. The egg is white and rather glossy ; it is small for the size of the bird, being only 1·38 × 1·0—*T. F. B.*"

Sub-family *Phabinæ.*

(238) CHALCOPHAPS INDICA.—The Bronze-winged Dove.

Blanford, No. 1291 ; *Jerdon, No.* 798.

This beautiful dove is common on the hills at all elevations during the dry weather ; at other times they confine themselves to the lower slopes. Mr. Bourdillon writes :—"I found a nest with two eggs in a bush about eight feet from the ground at Shaliakarai ; the eggs were pale *café-au-lait* and glossy, and measured 1· × ·81."

Sub-family *Columbinae.*

(239) COLUMBA INTERMEDIA.—The Indian Blue Rock-Pigeon.

Blanford, No. 1292 : *Jerdon, No.* 788.

Common in the low country, frequenting paddy fields. During the dry months they ascend the hills up to 2,500 feet elevation in South Travancore, feeding during the day and returning in the evening to their roosting places in the low country. There is a large colony on a rock that rises out of the sea at Cape Comorin.

(240) Alsocomus elphinstonii.—The Nilgiri Wood-Pigeon.
Blanford, No. 1299 ; *Jerdon, No.* 786.

This is a common bird at the summits of the hills in South Travancore and at Pirmerd, and also on the High Range.

(241) Turtur suratensis.—The Spotted Dove.
Blanford, No. 1307; *Jerdon, No.* 795.

Abundant at the foot of the hills throughout the range. During the dry weather it ascends the hills, and I have shot it on the Cardamom hills and the High Range. "It breeds abundantly in the plains and along the foot of the hills. They have two or three broods in the year—between April and September. The nest is very slight and is usually placed from about eight to twelve feet from the ground.—*T. F. B.*"

(242) Turtur cambayensis.—The Little Brown Dove.
Blanford, No. 1309 ; *Jerdon, No.* 794.

This little dove is by no means common, and is only to be found in the dry region of the extreme south, not far from Cape Comorin.

(243) Turtur risorius.—The Indian Ring-Dove.
Blanford, No. 1310 ; *Jerdon, No.* 796.

Like the last, this is rare and only to be met with in the same locality.

Order GALLINÆ.

Sub-order Alectropodes.

Family *Phasianidæ.*

(244) Pavo cristatus.—The Common Peafowl.
Blanford, No. 1324 ; *Jerdon, No.* 803.

This well known bird was at one time common at the foot of the hills in South Travancore, but is no longer. It is also found on the hills about Pirmerd.

(245) Gallus sonnerati.—The Grey Jungle-fowl.
Blanford, No. 1330 ; *Jerdon, No.* 813.

Found at all elevations from the foot to the summit of the hills. During the cold weather the cocks may be heard crowing, especially in the early morning and towards sunset. They breed in February and March in South Travancore. Mr. F. W. Bourdillon found a nest, a mere depression in the ground, containing three eggs in March. I found one, also in March, containing seven eggs which were placed in a dead stump of a tree about three feet from the ground. Mr. T. F. Bourdillon found a nest at Pirmerd on August 20.

(246) GALLOPERDIX SPADICEA.—The Red Spur-fowl.
Blanford, No. 1349 ; *Jerdon, No.* 814.

This spur-fowl is common throughout the low country wherever there is forest. It does not ascend the hills, but frequents the foot of them. Breeds in April.

(247) EXCALFACTORIA CHINENSIS.—The Blue-breasted Quail.
Blanford, No. 1354; *Jerdon, No.* 831.

This pretty little quail is said "not to have been observed on the Malabar Coast, south of Bombay." It is, however, to be met with in the grass lands at Pirmerd. Stone coloured eggs, densely spotted with minute spots of brown and black, were brought to Mr. Bourdillon in June at Malayattur in North Travancore. They measured ·93 × ·75, and are, I believe, the eggs of this bird.

(248) COTURNIX COMMUNIS.—The Common or Grey Quail.
Blanford, No. 1355 ; *Jerdon, No.* 829.

The Museum contains no specimens of this quail, but I am informed that it is not uncommon on the grass lands at Pirmerd, where it is known as "the drummer" from the purring sound it makes.

(249) PERDICULA ASIATICA.—The Jungle Bush-Quail.
Blanford, No. 1357 ; *Jerdon, No.* 826.

Numbers of these birds are brought round alive from the eastern side to Trevandrum for sale; they are not taken in Travancore but in the dry district of Tinnevelly. They may be found, however, about Cape Comorin, but so far as I am aware nowhere else in Travancore.

(250) MICROPERDIX ERYTHRORHYNCUS.— The Painted Bush-Quail.
Blanford, No. 1359 ; *Jerdon, No.* 828.

I have only found this quail on the Cardamom hills and the High Range ; at the latter place and at Pirmerd it is the commonest species by far. Mr. T. F. Bourdillon took the eggs at Pirmerd in December.

(251) FRANCOLINUS PONDICERIANUS.—The Grey Partridge.
Blanford, No. 1375 ; *Jerdon, No.* 822.

This, as I have already pointed out, is one of the birds that are found alike in Northern Ceylon and in South Travancore, being fairly common in and about the neighbourhood of Cape Comorin, but not found elsewhere.

ORDER HEMIPODII.

Family TURNICIDÆ.

(252) TURNIX PUGNAX.—The Bustard Quail.
Blanford, No. 1382 ; *Jerdon, No.* 832.

Not uncommon in scrub jungle in the low country.

(253) TURNIX TANKI.—The Indian Button Quail.
Blanford, No. 1384 ; *Jerdon, No.* 834.

I have not met with this quail myself and there are no specimens in the Museum, but it appears to have been recorded from Travancore, so I include it in my list.

ORDER GRALLÆ.

Sub-order FULICARIÆ.

Family *Rallidæ.*

(254) HYPOTÆNIDIA STRIATA.—The Blue-breasted Banded Rail.
Blanford, No. 1389 ; *Jerdon, No.* 913.

These birds may be found scattered about in marshy thickets near the coast. From the contents of the stomach, beetles appear to be their chief food.

(255) PORZANA PUSILLA.—The Eastern Bailloris Crake.
Blanford, No. 1393 ; *Jerdon, No.* 910.

This is apparently a rare bird in Travancore. A single specimen was brought to me alive in December. It had evidently bred here as there was a young one with it.

(256) RALLINA SUPERCILIARIS.—The Banded Crake.
Blanford, No. 1395 ; *Jerdon, No.* 912.

As recorded by Mr. F. W. Bourdillon a single specimen of this crake was procured by me in 1875 in some paddy fields near the foot of the hills in South Travancore at about 400 feet elevation. I have not met with it since.

(257) AMAURORNIS FUSCUS.—The Ruddy Crake.
Blanford, No. 1398 ; *Jerdon, No.* 911.

This bird has only been recorded from Mysore and the Wynaad in Peninsular India, but it is fairly common in Travancore. The Museum contains six specimens—one purchased from an Anjengo collector without locality, two from an old collection, both labelled Travancore, and three taken at Kuttyani near Trevandrum in April.

(258) Amaurornis phœnicurus.— The White-breasted Waterhen.

Blanford, No. 1401 ; *Jerdon, No.* 907.

Found throughout the low country round the edges of paddy fields. Breeds in April.

(259) Gallinula chloropus.—The Moorhen.

Blanford, No. 1402 ; *Jerdon, No.* 905.

The Moorhen is by no means common in Travancore ; the Museum possesses only a single specimen.

(260) Gallicrex cinerea. —The Water-Cock.

Blanford, No. 1403 ; *Jerdon, No.* 904.

Not uncommon in and about rice cultivation in the low country.

(261). Porphyrio poliocephalus.—The Purple Moorhen.

Blanford, No. 1404 ; *Jerdon, No.* 902.

Common in all the larger lakes wherever there are reeds and rushes. Breeds in July and August.

Sub-order Otides.

Family *Otididæ.*

(262) Sypheotis aurita.—The Lesser Florican or Likh.

Blanford, No. 1416 ; *Jerdon, No.* 839.

A very occasional visitor to Travancore ; the only record I have of its occurrence is in 1876, when one was shot in some rushes in Trevandrum.

Order LIMICOLÆ.

Family Œdicnemidæ.

(263) Œdicnemus scolopax.—The Stone Curlew.

Blanford, No. 1418 ; *Jerdon, No.* 859.

I have on more than one occasion seen and shot this bird when snipe shooting at Valey, four miles from Trevandrum, where the soil is sandy and the place is clothed with shrubs and cocoanut trees. They were sometimes in small parties of three or four ; at others, solitary. It breeds here in August.

Family Glareolidæ.

Sub-family *Cursoriinæ.*

(264) Cursorius coromandelicus.—The Indian Courser.

Blanford, No. 1422 ; *Jerdon, No.* 840.

My collector shot two of these birds eight miles south of Quilon on some sandy plains in June 1902. Four more were subsequently obtained twelve miles south of Quilon. Among them was a young bird in quite immature plumage, so that I believe they must breed here. I have not found this bird in any other locality, and do not think it is likely to be seen further north.

Sub-family *Glareolinæ*.

(265) Glareola lactea.—The Small Indian Pratincole or Swallow-Plover.

Blanford, No. 1427 ; *Jerdon, No.* 843.

I have only received this bird from North Travancore, where flocks, consisting of a dozen or more individuals, were met with by my collectors at Velyani, near Alwaye, frequenting open flats on either side of the Alwaye river up to Malayaltur. Their food was mostly beetles and mosquitoes. They were found hunting for insects well after sunset.

(266) Metopidius indicus.—The Bronze-winged Jacana.

Blanford, No. 1428 ; *Jerdon, No.* 900.

This bird may be met with throughout the country in suitable localities, that is, where there are lakes or tanks well covered with weeds and water-lilies.

(267) Hydrophasianus chirurgus.—The Pheasant-tailed Jácana.

Blanford, No. 1429 ; *Jerdon, No.* 901.

Flocks of these very handsome Jacanas are common in the tanks in South Travancore, especially about Nagercoil, where they may be seen running over the weed-covered water, keeping, however, well away from the banks.

Family CHARADRIIDÆ.

Sub-family *Charadriinæ*.

(268) Sarcogrammus indicus.—The Red-wattled Lapwing.

Blanford, No. 1431 ; *Jerdon, No.* 855.

Common in the low country all over Travancore, going about in twos and threes or in small flocks, and generally found in the neighbourhood of water. It breeds in March.

(269) Sarciophorus malabaricus.—The Yellow-wattled Lapwing.

Blanford, No. 1433 ; *Jerdon, No.* 856.

Common like the last, but frequents open ground away from water. Its plaintive cry may be heard long after dark has set in.

(270) CHETTUSIA GREGARIA—The Sociable Lapwing.
Blanford, No. 1437 ; *Jerdon, No.* 852.

This bird is said to visit North-West India in winter as far south as Ratnagiri. In January 1900, when out snipe-shooting, I shot two of these lapwings out of a flock of five that were feeding in some paddy fields in Trevandrum. I have not met with any since. No doubt, the failure of the rains in 1899 in the North and the consequent famine had driven these stragglers so far south of their usual haunts to a land where famine is unknown and the rains never fail.

(271) CHARADRIUS FULVUS.—The Eastern Golden Plover.
Blanford, No. 1439 ; *Jerdon, No.* 845.

Flocks of these plovers may be met with commonly in North and Central Travancore about Cherayankie, Parur and Vycome in winter frequenting swampy flats and in paddy fields.

(272) ÆGIALITIS GEOFFROYI.—The Large Sand-Plover.
Blanford, No. 1442 ; *Jerdon, No.* 846.

A rare winter visitor to the coast. A single specimen was shot at Neendakaray, near Quilon.

(273) ÆGIALITIS MONGOLICA.—The Lesser Sand-Plover.
Blanford, No. 1443 ; *Jerdon, No.* 847.

A winter visitor to the coasts, but sometimes found inland. Curiously enough, one specimen was obtained on the High Range at 6,000 feet elevation. It is often seen in company with the Little Ringed Plover.

(274) ÆGIALITIS ALEXANDRINA.—The Kentish Plover.
Blanford, No. 1446 ; *Jerdon, No.* 848.

This plover was found to be fairly numerous at Neendakaray in January.

(275) ÆGIALITIS DUBIA.—The Little Ringed Plover.
Blanford, No. 1447 ; *Jerdon, No.* 849.

I do not think this bird is a resident, but it comes very early to the coast. I have seen stragglers at Cape Comorin early in August, and flocks of them may be seen as late as April. They are abundant in the dry rice fields after harvest and about the shores of tanks and beds of streams in the low country.

Sub-family *Hœmatopodinœ.*

(276) HÆMATOPUS OSTRALEGUS.—The Sea-pie or Oystercatcher.

Blanford, No. 1450; *Jerdon, No.* 862.

The oystercatcher is a more or less rare winter visitor to the coast. It is generally found in small flocks of half a dozen or so, feeding on crustaceans mostly.

Sub-family *Totaninœ.*

(277) NUMENIUS ARQUATA.—The Curlew.

Blanford, No. 1454; *Jerdon, No.* 877.

Like the last only found in the coast in winter, but not in any great numbers.

(278) NUMENIUS PHÆOPUS.—The Whimbrel.

Blanford, No. 1455; *Jerdon, No.* 878.

May be found in suitable places along the coast in fair numbers from October to April. I have usually found it solitary.

(279) TOTANUS HYPOLEUCUS.—The Common Sandpiper.

Blanford, No. 1460; *Jerdon, No.* 893.

One of the most widely spread of birds. It is common in the paddy fields everywhere from September to May, usually in pairs or in small parties of four or five; on the margins of tanks or on the seashore its clear piping note may be heard.

(280) TOTANUS GLAREOLA.—The Wood Sandpiper.

Blanford, No. 1461; *Jerdon, No.* 891.

This is by far the commonest of the sandpipers, and may be found in abundance in the wet paddy fields from August to May either solitary or in flocks.

(281) TOTANUS OCHROPUS.—The Green Sandpiper.

Blanford, No. 1462; *Jerdon, No.* 892.

Not nearly so common as the last. It may generally be found in the winter months solitary about the borders of tanks or the beds of rivers. On one occasion I shot one in a swamp on the High Range at an elevation of 6,000 feet in January.

(282) TOTANUS STAGNATILIS.—The Marsh Sandpiper or Little Greenshank.

Blanford, No. 1463; *Jerdon, No.* 895.

My collectors met with flocks of these birds on the seashore at Manahodam Bar and at North Parur. They were in company with *T. glottis.*

(283) TOTANUS CALIDRIS.—The Redshank.

Blanford, No. 1464 ; *Jerdon, No.* 897.

A single specimen was shot by my collectors at Neendakaray in January 1903.

(284) TOTANUS GLOTTIS.—The Greenshank.

Blanford, No. 1466 ; *Jerdon, No.* 894.

Like the others a winter visitor. I have not met with it in the South, but my collectors saw flocks of them on the sides of the rivers and in marshes in North Travancore, and obtained specimens at Yettamanne, Shertally, and Vycome.

(285) TRINGA MINUTA.—The Little Stint.

Blanford, No. 1471 ; *Jerdon, No.* 884.

A fairly common visitor to the coast of North Travancore in winter, but not found inland. It often associates with *Tringa subarquata.* It forms larger flocks, as a rule, than the other stints.

(286) TRINGA SUBARQUATA.—The Curlew Stint or Pigmy Curlew.

Blanford, No. 1477 ; *Jerdon, No.* 882.

This fine stint is found from October to April on the coast of North Travancore, especially about Manakodam Bar. When it associates with *Tringa minuta,* only a few individuals are found, but it forms flocks of from eight to twelve when alone.

(287) TRINGA PLATYRHYNCHA.—The Broad-billed Stint.

Blanford, No. 1479 ; *Jerdon, No.* 886.

A single specimen of this stint was shot by my collectors at Manakodam Bar in January 1903.

Sub-family *Scolopacinæ.*

(288) SCOLOPAX RUSTICULA.—The Woodcock.

Blanford, No. 1482 ; *Jerdon, No.* 867.

Occasional specimens of this bird may be met with in grass land bordered by forest in South Travancore at elevations of about 4,000 feet in the winter. On the High Range in similar localities before the forest was cut down for coffee and tea cultivation, it used to be fairly common at this period.

(289) GALLINAGO NEMORICOLA.—The Wood-snipe.

Blanford, No. 1483 ; *Jerdon, No.* 868.

A solitary bird, of which the Museum possesses only one specimen shot on the High Range.

(290) GALLINAGO CŒLESTIS.—The Common Snipe, Full or Fantail Snipe.

Blanford, No. 1484 ; *Jerdon, No.* 871.

About one-quarter or sometimes a third of the whole bag in a day's snipe shooting here will be found to consist of these birds. Further North I am told that they form even a higher proportion. They arrive later than the pintail, and leave earlier.

(291) GALLINAGO STENURA.—The Pintail Snipe.

Blanford, No. 1485 ; *Jerdon, No.* 870.

A few stragglers arrive early in September, and again a few belated individuals may be found at the end of April. Between these dates varying numbers may be met with. They are fond of harbouring in the low scrub jungle surrounding the rice fields both before and after the crops are cut.

(292) GALLINAGO GALLINULA.—The Jack Snipe.

Blanford, No. 1487 ; *Jerdon, No.* 872.

A few specimens of this little snipe used generally to be found solitary from year to year in certain damp rushy ground in Trevandrum ; since this has been taken into cultivation, I have not met with any more.

(293) ROSTRATULA CAPENSIS.—The Painted Snipe.

Blanford, No. 1488.

This beautiful bird is fairly common throughout the low country wherever there are rushy marshes. When shooting, I have also often flushed it from paddy fields. It breeds here, and I have had eggs brought to me in December and young birds in February.

ORDER GAVIÆ.

Family LARIDÆ.

Sub-family *Larinæ.*

(294) LARUS ICTHYAËTUS.—The Great Black-headed Gull.

Blanford, No. 1489 ; *Jerdon, No.* 979.

In January 1903 the Museum collectors shot five specimens of this fine gull at Kayankolam Bar. They do not appear to reach the coast much earlier than this, as in December of the same year there were no birds to be seen at this place.

(295) LARUS RIDIBUNDUS.—The Laughing Gull.

Blanford, No. 1490 ; *Jerdon, No.* 981.

This bird was found to be fairly common at the same locality as the last at the same period.

(296) LARUS BRUNNEICEPHALUS.—The Brown-headed Gull.

Blanford, No. 1491 ; *Jerdon, No.* 980.

In December 1901 I found numbers of these gulls surrounding some fishermen who were drawing their nets in a shallow lake close to the sea near Cape Comorin. They moved quite fearlessly around them, but when I sent a man to wade in, they would not let him approach ; but I secured one subsequently on the sandy banks.

(297) LARUS AFFINIS.—The Dark-backed Herring Gull.

Blanford, No. 1494 ; *Jerdon, No.* 978.

A single specimen was obtained by the Museum collectors at Kayankolam in January 1903.

Sub-family *Sterninæ.*

(298) HYDROCHELIDON HYBRIDA.—The Whiskered Tern.

Blanford, No. 1496 ; *Jerdon, No.* 984.

This marsh tern is abundant in North Travancore, frequenting the coast, the backwaters and paddy fields in the winter months.

(299) HYDROPROGNE CASPIA.—The Caspian Tern.

Blanford, No. 1498 ; *Jerdon, No.* 982.

This fine tern was found in fair numbers at Kayankolam Bar in January 1903. It is not so gregarious as the last, being generally seen in pairs.

(300) STERNA ANGLICA.—Gull-billed Tern.

Blanford, No. 1499 ; *Jerdon, No.* 983.

Fairly common in winter about the back waters of North Travancore and also frequenting the coast at Manakolam Bar.

(301) STERNA MEDIA.—The Smaller Crested Tern.

Blandford, No. 1501 ; *Jerdon, No.* 990.

This is the commonest and most abundant of the terns, and may be found frequenting the back waters and coast from Quilon northwards. It is fond of sitting on the wooden posts that mark the channel through the lakes.

(302) STERNA BERGII.—The Large Crested Tern.

Blandford, No. 1502 ; *Jerdon, No.* 989.

Numbers of this fine tern were found at Kayankolam Bar and further North in January and December 1903.

(303) Sterna fluviatilis.—The Common Tern.

Blandford, No. 1506 ; *Jerdon, No.* 986.

An occasional winter visitor to the coast of South Travancore. I have not met with it at all in the North. The few specimens taken have been immature.

(304) Sterna saundersi.—The Black-shafted Ternlet.

Blandford, No. 1511 ; *Jerdon, No.* 988.

A single specimen was shot in North Travancore on the coast in January 1903.

Order STEGANOPODES.

Family Pelecanidæ.

(305) Pelecanus philippensis.—The Spotted-billed Pelican.

Blandford, No. 1523 ; *Jerdon, No.* 1004.

I have not secured a specimen of this bird, but it occurs in South Travancore, and I once saw three flying over the parade ground in Trevandrum.

Family FREGATIDÆ.

(306) Fregata ariel.—The Small Frigate-bird.

Blandford, No. 1525.

A young bird of this species was taken at Perumathoray about ten miles from Trevandrum, and was brought to me alive.

Family PHALACROCORACIDÆ.

Sub-family *Phalacrocoracinæ*.

(307) Phalacrocorax javanicus.—The Little Cormorant.

Blandford, No. 1528 ; *Jerdon, No.* 1007.

The Museum does not contain any specimens of this bird, but I have seen it in the tanks and lakes in and about Nagercoil in South Travancore.

Sub-family *Plotinæ*.

(308) Plotus melanogaster.—The Indian Darter or Snake-bird.

Blanford, No. 1529 ; *Jerdon, No.* 1008.

This bird is common on all the larger fresh water lakes throughout Travancore. It is abundant on the lake formed by the Pergár dam at 3,000 feet elevation on the hills, and equally common on the Sasthancotta lake in the low country. It breeds here in September as in North India and not in February as in Madras and Ceylon. "I once found a colony of these birds nesting above the Athirapuzha fall in the Kodashéri river in September. They had taken possession of an island in midstream, where they had built their untidy nests on small trees about 20 feet high, and there were fresh and hard-set eggs in them in all stages of incubation, while half-fledged birds scrambled about the branches or flopped into the water at our approach. The nests were about one foot in diameter and roughly built of twigs. The eggs are white and covered with a chalky coat and measure 2 inches by 1¼. Some of the eggs are rather larger at one end than the other, while others are truly fusiform with pointed ends.—*T. F. B.*"

ORDER TUBINARES.

Family PROCELLARIIDÆ.

(309) PUFFINUS PERSICUS.—The Persian Shearwater.

Blanford, No. 1539.

A single specimen was taken at Valey, four miles from Trevandrum, and was brought to me alive.

ORDER HERODIONES.

Sub-order PLATALEÆ.

Family *Ibidæ.*

(310) IBIS MELANOCEPHALA.—The White Ibis.

Blanford, No. 1541 ; *Jerdon, No.* 941.

I am doubtful whether this bird is a resident here. I have only seen it in the cold weather at Sastancotta. They feed by day in the paddy fields, and are difficult to approach ; but they generally roost in trees on the banks of the lake, and specimens can be obtained by waiting for them in the evening.

Sub-order CICONIÆ.

Family *Ciconiidæ.*

(211) DISSURA EPISCOPUS.—The White-necked Stork.

Blanford, No. 1548 ; *Jerdon, No.* 920.

The Museum only contains one skin of this bird, obtained on the banks of the river at Pálode. Another specimen was brought in alive taken on the banks of one of the tanks about Nagercoil.

(312) LEPTOPTILUS JAVANICUS.—The Smaller Adjutant.

Blanford, No. 1551 ; *Jerdon, No.* 916.

This bird is by no means common, but may be found about the tanks in South Travancore. Live specimens have been brought in to the gardens from time to time. One of these lived for several years in captivity. It was very pugnacious, and with one blow of its beak split open the head of another bird newly introduced into its run as a companion. On one occasion a jackal found its way into the run, and in the morning was found dead with its skull pierced by the beak of the bird.

(313) ANASTOMUS OSCITANS.—The Open-bill.

Blanford, No. 1553 ; *Jerdon, No.* 940.

This stork is very common, and large flocks may be met with on the marshy borders of all the larger tanks and fresh water lakes. I have seen numbers of them perching at sunset on the same trees with flocks of *Plotus melanogaster*. I have not taken the eggs, but I conclude that the breeding season must be in June, as all those I saw in January were in the grey plumage. Natives say that they will feed on dead bodies, but I have not seen this myself.

Sub-order ARDEÆ.

Family *Ardeidæ*.

(314) ARDEA MANILLENSIS.—The Eastern Purple Heron.

Blanford, No. 1554 ; *Jerdon, No.* 924.

Mr. F. W. Bourdillon records this heron as "abundant at the Vellarney Lake," seven miles from Trevandrum. This used to be a favourite resort for all kinds of water birds, but since the reeds, with which it was more or less covered have been removed, only a few whistling teal and some snake birds persist. No herons are to be seen there now. I have seen and shot the Purple Heron at Sastamcotta. It is a solitary bird and very shy, never to be seen in the open except on the wing, but always in sheltered bays where there are reeds or thickets of pandamus. It breeds in July and August.

(315) ARDEA CINEREA.—The Common Heron.

Blanford, No. 1555 ; *Jerdon, No.* 923.

The common heron frequents the backwaters along the coast throughout Travancore, but is not found in the interior. One has lived in captivity in the public gardens over seventeen years.

(316) HERODIAS ALBA.—The Large Egret.

Blanford, No. 1559 ; *Jerdon, No.* 925.

The large egret is by no means common in Travancore, and it is only lately that the Museum has secured a specimen. It is a wary bird and impossible to approach when feeding in the paddy fields at most times solitary. At Sastamcotta they roost in company on the trees round the lake, and can be secured by waiting for them after sunset. They appear to be the last to seek repose, as they come in long after the ibises and snake birds have gone to rest.

(317) HERODIAS INTERMEDIA.—The Smaller Egret.
Blanford, No. 1560 ; *Jerdon, No.* 926.

This bird is fairly common about the edges of the backwaters and lakes from Quilon northwards. It is not nearly so abundant in the South. Unlike the large egret, it is usually to be seen in companies of at least three or four and often more. It is not easy to get at, as it is decidedly shy.

(318) HERODIAS GARZETTA.—The Little Egret.
Blanford, No. 1561 ; *Jerdon, No.* 927.

The little egret is not uncommon about the back waters along the coast, going about solitary or in pairs.

(319) BUBULCUS COROMANDUS.—The Cattle Egret.
Blanford, No. 1562 ; *Jerdon, No.* 929.

This is by far the commonest of the white egrets, and may be found in numbers in all paddy fields throughout Travancore along the backwaters and in cultivated land. It assumes the breeding plumage about April.

(320) LEPTERODIUS ASHA.—The Indian Reef-Heron.
Blanford, No. 1563 ; *Jerdon, No.* 928.

A single specimen was obtained by the Museum collectors at Ayrentenga, on the coast near Kayankolum. It was perched on a cocoanut palm.

(321) ARDEOLA GRAYI.—The Pond Heron.
Blanford, No. 1565 ; *Jerdon, No.* 930.

One of the commonest and most familiar of birds throughout the whole country.

(322) BUTORIDES JAVANICA.—The Little Green Heron.
Blanford, No. 1567 ; *Jerdon, No.* 931.

Mr. F. W. Bourdillon says that this "is a winter visitor. It is very silent and solitary. During the months of November to March it is to be found among the rocks of the larger streams up to about 2,000 feet elevation, and always in dense jungle." It is common in the low country from November to April, but I have not met with it at any other time of the year. This seems to agree with the habit of the bird as recorded by Colonel Legge in Ceylon, who says of it : "Throughout the year it is to be met with near Kotte and similar places on the west coast; but, as a rule, it is not often seen after April in that part of the island."

(323) NYCTICORAX GRISEUS.—The Night Heron.

Blanford, No. 1568; *Jerdon, No.* 937.

I have not come across this bird myself, but the Museum possesses two skins, and the collectors found it fairly common at Perambúlum, in North Travancore, and at other places round the Vembenad lake. The inhabitants, however, refused to allow them to shoot any specimens.

(324) GORSACHIUS MELANOLOPHUS.—The Malay Bittern.

Blanford, No. 1569.

Mr. F. W. Bourdillon obtained a specimen of this fine bittern on the hills at about 2,500 feet elevation in 1878. Since then I have received two specimens taken alive. One of these is now living in the Public Gardens. No doubt, they were captured on the shore shortly after their arrival on the coast, for these birds are jungle haunters.

(325) ARDETTA SINENSIS.—The Yellow Bittern.

Blanford, No. 1571; *Jerdon, No.* 934.

I have not shot this bird myself, but the Museum collectors brought back several specimens from North Travancore, where it was found solitary on the banks of the back waters about Cottayam and Vycome.

(326) ARDETTA CINNAMOMEA.—The Chestnut Bittern.

Blanford, No. 1572; *Jerdon, No.* 933.

This little bittern is common throughout Travancore on all the lakes and backwaters. It is fond of taking up its stand in the canals cut through the ground laid out for the cultivation of young cocoanut palms.

(327) DUPETOR FLAVICOLLIS.—The Black Bittern.

Blanford, No. 1573; *Jerdon, No.* 932.

The black bittern is not uncommon along the backwaters. It particularly frequents the canals whose banks are densely clothed with trees and bushes, especially where there is a thick growth of screw pines. I have never seen it away from such localities. It remains under cover during the day, but may be flushed by the too near approach of a passing boat. At dusk it comes out to search for food.

ORDER ANSERES.

Family ANATIDÆ.

Sub-family *Anatinæ*.

(328) DENDROCYCNA JAVANICA.—The Whistling Teal.

Blanford, No. 1589 ; *Jerdon, No.* 952.

The whistling teal is common on all weedy tanks and lakes throughout Travancore. On one such piece of fresh water, near Sastamcotta, I saw hundreds in April 1902 ; but in December 1903, in the same place, not a single one was to be found. It is, perhaps, commoner in the North than the South.

(329) NETTOPUS COROMANDELIANUS.—The Cotton Teal.

Blanford, No. 1591 ; *Jerdon, No.* 951.

This pretty little teal is, I think, only a winter visitor, and is never abundant at any time.

(330) NETTIUM CRECCA.—The Common Teal.

Blanford, No. 1597 ; *Jerdon, No.* 964.

A single specimen of this bird was shot in South Travancore.

(331) QUERQUEDULA CIRCIA.—The Garganey or Blue-winged Teal.

Blanford, No. 1601 ; *Jerdon, No.* 965.

Large flocks may be met with on the backwaters in North Travancore in winter.

(332) PODICIPES ALBIPENNIS.—The Indian Little Grebe or Dabchick.

A permanent resident and not uncommon; breeds in August.

Blanford, No. 1617.

NEW SPECIES OF INDIAN HYMENOPTERA.

By Major C. G. Nurse, 113th Infantry, Indian Army.

(*Read before the Bombay Natural History Society on 18th August* 1904.)

In addition to species now described for the first time, I have, as usual, given the names of several others obtained by me which are new to India, so as to render the list of those that are known to have occurred within Indian limits as complete as possible. I sent a number of *Chrysididæ* to M. du Buysson, and he informs me that the following three species described by me as new, belong to species already described. As his knowledge of this family is probably unrivalled, and he has opportunities for comparing specimens with types and others which are denied to a field entomologist like myself, I defer to his opinion, and suppress my species—

Notozus kashmirensis (*Nurse*) = N. violascens (*Mocs.*).
Ellampus timidus (*Nurse*) = E. hypocrita (*Buyss.*).
Chrysis thalia (*Nurse*) = C. acceptabilis (*Rad.*).

As regards the genus *Notozus*, I cannot agree with Col. Bingham in uniting it with *Ellampus*. The two genera seem to me to be distinct, though allied. M. du Buysson keeps them distinct, as does Dr. W. H. Ashmead in his classification in the Canadian Entomologist, and Col. Bingham has shown no reason for uniting them.

Holopyga gloriosa (*Fabr.*) var viridis (*Guer.*).

Five specimens from Quetta.

Hedychridium amatum, n. sp.

♀ Front sharply angled below vertex, and with very thick, snow white pubescence, hiding the sculpturing; head, pronotum and abdomen closely, remainder of thorax more coarsely punctured; head as wide as pronotum, abdomen about the length of thorax, and with a median longitudinal carina on second segment. Shining green, with a cupreous effulgence on second abdominal segment; antennæ and tarsi rufo-testaceous; wings clear hyaline, tegulæ deep blue. The whole insect is covered with a short, sparse, greyish pubescence, and the last few joints of the antennæ with a thin, silvery pile, the latter only visible with a microscope.

Long. 4-5 *mm.*

Habitat: Deesa.

Nearest to *H. minutum*, but may be distinguished by the cupreous effulgence being confined to the second abdominal segment, and by the carina on the same segment.

HEDYCHRIDIUM ROTUNDUM, n. sp.

♀ Head and thorax closely and coarsely, abdomen closely and very finely punctured, the third segment somewhat less finely than the second; front above the base of antennæ somewhat convex, head slightly wider than pronotum, abdomen much wider than thorax, very rounded posteriorly, shorter than the thorax and median segment united. Head and thorax blue-green, dark-blue on the front and at the different divisions of the thorax ; abdomen shining metallic green, without any cupreous effulgence ; antennæ and tarsi rufo-testaceous; wings hyaline, tegulæ reddish brown ; a very little sparse greyish pubescence on the cheeks and abdomen.

Long. 5 *mm.*

HABITAT : Deesa.

Nearest to *H. amatum* above, but may be at once distinguished from it by the very finely punctured abdomen.

HEDYCHRUM LAMA (*Buyss.*).

This species is not uncommon at Quetta.

HEDYCHRUM MONOCHROUM (*Buyss.*).

One specimen from Quetta.

CHRYSIS PULCHELLA (*Spin.*).

One specimen from Quetta.

CHRYSIS SARA, n. sp.

♀ Slenderly built; facial cavity quadrate, pubescent, margined by a slight carina ; head and thorax closely but not deeply punctured, the punctures largest in the centre above; abdomen more finely punctured than head and thorax, apical portion of third segment with a pellucid or chitinous margin, which is bi-emarginate or tridentate, all the teeth blunt, the middle one projecting furthest. Dark-blue, with greenish reflections ; antennæ, except the first two joints, rufo-piceous; all the tarsi pale rufo-testaceous; pubescence short, greyish, sparse; wings hyaline, the nervures pale.

Long. 3-5 *mm.*

HABITAT :—Quetta; a single specimen.

This species, having a pellucid margin to the third abdominal segment, would belong to Klug's genus *Spintharis*, but I follow du Buysson in considering that this difference is not of sufficient importance to warrant the separation of *Spintharis* from *Chrysis*.

Chrysis deposita, n. sp.

♀ Facial hollow not very concave, terminated above by a slight carina; head and thorax finely and somewhat closely punctured, abdomen, especially the second and third segments, more finely and closely punctured than the head and thorax; pronotum transverse anteriorly, with a slight median impression, its sides very slightly concave; second abdominal segment with a trace of a median longitudinal carina, third segment with its apical margin bluntly rounded, without teeth, and with an anteapical series of eight or ten distinct, rather large, foveæ. Bright green; the central quadrate portion of the mesonotum and the lateral angles of the median segment dark-blue; second and third abdominal segments with coppery effulgence; antennæ and tarsi piceous; wings hyaline, nervures rufo-piceous to piceous.

Long. 7 *mm.*

Habitat: Quetta; a single specimen.

Nearest to *C. pelopœcida* from Jerusalem.

Chrysis chlorochrisa (*Mocs.*).

In the Entomologist, Vol. XXXVI, p. 40, I described under the name of *C. hoggei* what appeared to me to be a new species of *Chrysis.* I sent specimens to Lt.-Col. Bingham and M. du Buysson. The former, in Vol. II, Hymenoptera, of the Fauna of India series, united *C. hoggei* with *C. perfecta* (Cam.) from Barrackpore. M. du Buysson identified the ♀ as *C. subcœrulea* (Rad.) and the ♂ as *C. chlorochrisa* (Mocs.). In his volume on the Chrysididæ of "Species des Hymenopteres d' Europe," p. 500, M. du Buysson observes that the ♂ described by Radoszkowsky, as *C. subcœrulea* is *C. chlorochrisa* (Mocs.). Accepting this identification of the ♂, and taking into consideration that both Radoszkowsky and I united these as the same species quite independently, it appears to me that the name of *chlorochrisa* should stand for both sexes, and that both *C. subcœrulea* (Rad.) and *C. hoggei* (Nurse) must be sunk as synonyms. Whether *C. perfecta* (Cam.) is another species or only a variety I cannot express an opinion, not having seen a specimen. I may mention that I have about a dozen specimens of each sex, all obtained at Quetta, and I have no doubt whatever that they are one species. I should not venture to differ from such a high authority as M. du Buysson without having considerable material at my disposal.

CHRYSIS DENTIPES (*Rad.*).

Two specimens from Quetta.

CHRYSIS PSITTACINA (*Buyss.*)

A single specimen from Quetta.

CHRYSIS URANA, n. sp.

♀ Head and pronotum somewhat irregularly but closely, remainder of thorax more coarsely punctured, abdomen closely and finely punctured ; head somewhat wider than pronotum, the latter with its anterior margin strongly rounded, and with a median longitudinal depression ; first abdominal segment with three deep impressions at base, second segment with a trace of a longitudinal carina, third segment with an anteapical series of foveæ which are large and conspicuous in the middle, obscure laterally ; the segment quadridentate, the teeth long and acute, about equidistant, the central pair projecting much beyond the lateral ones. Dark-blue, with greenish reflections, antennæ and tarsi piceous ; wings hyaline, nervures rufo-testaceous to piceous.

Long. 6-5 *mm.*

HABITAT : Quetta ; two specimens.

Nearest to *C. grohmanni* (Dahlb.).

CHRYSIS REPARATA, n. sp.

♂ Head as wide as pronotum, transverse, viewed from the front slightly longer than broad ; the space between the base of the mandibles and the lower margin of the eyes very large, the base of the antennæ being distinctly below the level of the lower margin of the eyes ; clypeus raised in the centre, its anterior margin slightly emarginate ; antennæ filiform, the second joint of the flagellum the longest, nearly twice the length of the next joint ; clypeus and front finely and shallowly punctured, the size of the punctures increasing towards the vertex, where they become close, deeper and almost granular ; thorax coarsely punctured, the punctures being finer at the base of the mesonotum than elsewhere on the thorax ; abdomen longer than head and thorax united, very broad, closely punctured, the punctures being smaller than those on the thorax, those on the first abdominal segment only slightly so ; second and third segments with a very distinct longitudinal carina ; five teeth on the third segment as follows ; the middle tooth short, obtuse, the two outer pairs acute but not very long ; the anteapical series of foveæ distinct. Dark-blue, the clypeus and front in some specimens light green ; second abdominal segment with a lateral spot light green; scape, first two joints of flagellum, and legs, except the tarsi, bluish green; remainder of flagellum, and the tarsi piceous; the anterior portion of the mesonotum black; facial hollow with rather long, thick, silvery pubescence, antennæ and all the tarsi with thick short pile; forewing with the base hyaline, the apical half very slightly infuscated, hindwing hyaline; nervures piceous, tegulæ purple.

Long. 11 *mm.*

HABITAT: Quetta; three specimens.

EUCHRŒUS PURPURATUS (*Fabr.*).

Fairly common at Peshin and Quetta; the wings of those that I obtained are hyaline, not infuscated as is usual in this species.

EUCHRŒOIDES, n. gen.

Differs from *Euchrœus* in having the mesopleurae produced into a conspicuous tubercle, the sides of which are carinate; the radial cell is broader and more open at apex than in *Euchrœus*, and the teeth on the apical abdominal segment are longer and more regular than in that genus; there is, moreover, scarcely a trace of pubescence in either sex. This genus is closely allied to *Euchrœus*, but the very conspicuous tubercle on the mesopleurae is, I consider, sufficient to separate them.

In the shape of the radial cell it approaches *Spinolia*, and its position would seem to be between these two genera.

EUCHRŒOIDES OBLATUS, n. sp.

♀ Facial hollow closely and finely punctured, vertex very closely, but more coarsely punctured, granular; thorax more coarsely punctured than vertex, especially on scutellum and postscutellum; first and second abdominal segments, especially on the disc above, more sparsely and shallowly, third segment closely and finely punctured; head slightly broader than pronotum, no transverse carina above the facial hollow, but a slight longitudinal carina in front of anterior ocellus; third joint of antennæ slightly longer than the fourth; pronotum with the sides slightly converging anteriorly, and with a median impression at base; mesopleurae with a very large tubercle, the sides of which are carinate; abdomen about as long as head and thorax united, third segment longer and less bluntly pointed than in the genus *Euchrœus*, almost semicircular, with fourteen teeth, the latter very regular; a subapical row of about eighteen small foveæ. Metallic coppery green, the clypeus and abdomen more distinctly coppery golden; antennæ very dark red, the first two joints metallic purple; anterior femora metallic green, anterior tibiæ and intermediate and posterior femora and tibiæ metallic purple; anterior tarsi dark testaceous, intermediate and posterior tarsi piceous; ventral abdominal segments metallic purple; almost entirely devoid of pubescence or pile; wings hyaline, nervures blackish, tegulæ of the same colour as thorax.

♂ Similar, the abdomen proportionately broader, the third segment shorter and more obtuse at apex, the teeth longer but not quite so regular; a slight carina above facial hollow, and the portions of the front on each side of the carina which runs towards the anterior ocellus flattened and depressed, the punctures on this portion running into longitudinal striæ; the clypeus and the whole of the front below the anterior ocellus deep-blue, changing into purple in some lights; second joint of antennæ metallic green.

Long. 8 *mm.*

HABITAT: Quetta; a single specimen of each sex.

PARNOPES VARILLESI (*Buyss.*).

One specimen from Quetta.

MUTILLA VESTA, n. sp. (*Dudgeon MS.*)

Eyes wide apart, small and round; head and thorax coarsely punctured, abdomen longitudinally striate; head slightly wider than thorax, rounded and without a carina; thorax sub-hexagonal, being extended laterally into a sharp tubercle, dorsally convex; abdomen with the first segment constricted, and with a sharp ventral carina. Head, antennæ, legs, and abdomen black; thorax brick red; head and thorax sparsely clothed with coarse black hairs, abdomen with black pubescence, a broad band of golden pubescence on the apical margin of the first, and a narrower one on the apical margin of the second segment; some golden pubescence on the sides of the third and fourth segments; tibiæ and tarsi with silvery pubescence.

Long. 29 *mm.*

HABITAT: Baijnath, Kangra Valley, 3,000 feet.

Position in Bingham's key—A. f. á. Much larger than any of the others in this group, and differs in having the first abdominal segment constricted, with a broad gold band on its apical margin, and also in the eyes being small and wide apart.

ASTATA LUCINDA, n. sp.

Front and mesonotum minutely and shallowly punctured, scutellum and postscutellum almost impunctate, median segment minutely rugose, abdomen smooth and shining ; clypeus very concave at base, its anterior margin emarginate ; antennæ long, filiform, the second joint of flagellum longer than the third ; front above the base of antennæ raised, with a median notch ; an impressed longitudinal line on scutellum ; abdomen small, shorter and narrower than the thorax, pygidium smooth. Black ; a large irregular spot on the front below the ocelli, a spot below the bases of the wings, and two oval spots on each of the first two abdominal segments, yellow, the spots on first segment frequently coalescing ; tibiæ and tarsi of anterior legs red ; pubescence white, very fine and silky, but somewhat sparse ; wings clear hyaline and iridescent, a fuscescent patch on the radial and second and third cubital cells ; radial cell short, broadly truncate at apex ; second cubital cell almost triangular, third cubital cell about half as wide above as below ; tegulæ yellow ; nervures of forewing for the most part brownish testaceous, except for a short distance from the tegulæ, where they are very pale yellowish ; those of hindwing very pale.

Long. 6-8 *mm.*

HABITAT : Quetta ; six specimens.

Nearest to *A. quadripunctata* (Rad.) ; but may be at once distinguished by the antennæ being entirely black.

AMMOPHILA BOLANICA (*Nurse*).

When I described this species in Journal Bombay Natural History Society, Volume XV, p. 8, I had not obtained a male. I subsequently caught both sexes in coitu, and found that the ♂ differs to a considerable extent from the ♀, so I give its full description.

♂ Head and thorax apparently finely punctured, but with the sculpturing almost hidden by the pubescence ; median segment very minutely striate, the striæ at base being outwardly divergent, becoming almost transverse towards the apex of the segment ; abdomen impunctate, pruinose ; clypeus very long, its anterior margin produced and slightly emarginate or notched ; scutellum slightly notched ; median segment rather long, gradually sloping and narrowed towards apex ; petiole slightly longer than the next abdominal segment. Black ; clypeus and front with rather long silvery pile, intermixed with long black hairs ; thorax with blackish pubescence ; abdomen with segments 2—4 above covered with short but conspicuous silvery pile ; wings hyaline, with the apical margin of forewing infuscated as far as the neuration.

Long. 12-15 *mm.*

EUMENES MONTANA, n. sp.

♀ Clypeus smooth, front punctured, the punctures increasing in size towards the vertex, where they are close and deep ; thorax, median segment, and petiole closely but shallowly punctured, almost granular ; remaining abdominal segments impunctate ; clypeus produced, its apex transverse ; mesonotum with two impressed parallel longitudinal lines on it's apical half ; scutellum with a slight median longitudinal carina at base ; median segment almost vertical, with a broad groove ; petiole shorter than thorax, narrow at base, widening towards the centre, where it is three times as wide as at base ; second abdominal segment as long as or longer than the petiole. Red ; the clypeus and the portion of front immediately above it yellowish ; apical four joints of antennæ, vertex, and some marks on mesonotum blackish ; second abdominal segment narrowly black at base, then red, then with a broad black band, it's apex narrowly yellow ; the visible part of the remaining abdominal segments yellow ; ventral abdominal segments similarly coloured, except that the second segment has no yellow band at apex ; almost entirely without pubescence ; wings flavo-hyaline, with infuscated patches at apex of forewing, nervures rufo-testaceous, darker towards apex, tegulæ red.

Long. (to end of second abdominal segment). 17 *mm.*

HABITAT : Quetta ; two specimens.

This species is in colour very similar to *E. petiolata* (Fabr.), but the petiole in that species is about twice as long as in the present and is differently shaped. The present species is nearest to *E. arbustorum* (Penzer) as regards the shape of petiole, but differs in colouring.

HALICTUS ORPHEUS, nom. nov.

In Vol. LXX, Part II, of the Journal of the Asiatic Society, p. 148, I described a species of *Halictus* under the name of *H. testaceus.* I find that this name had already been given to a North American species, and I, therefore, propose to rename my species *H. orpheus.* In a genus like *Halictus*, which occurs almost all over the world, it is very difficult to be certain that a name has not been used before.

SEXUAL COLOUR-DIMORPHISM IN BIRDS.

BY D. DEWAR, I.C.S.

(*Read before the Bombay Natural History Society on 18th August* 1904.)

Probably more than half the species of birds display sexually dimorphic plumage. This colour dimorphism varies from an almost imperceptible difference, as in many woodpeckers and some parakeets, to a divergence so great that the male and female were originally supposed to belong to different species. As an extreme case of sexual dimorphism, the Indian paradise flycatcher (*Terpsiphone paradisi*) may be cited.

We are still almost completely in the dark as regards the causes of this sexual differentiation, and we are likely to remain so until more light has been shed on the causes which determine the origin of variations.

It is needless to say that Darwin attributed such dimorphism to sexual selection. His theory is that in the great majority of species, there is competition among the males for females, and that the latter are therefore able to, and actually do, exercise a selection. They are able to pick and choose their mates, and they select the most brilliant of their suitors. Thus have arisen the beautiful plumage and all the accessory plumes of cock birds.

These decorations have in many cases not been transmitted to females, because natural selection tends to obliterate all conspicuous colours, and in the case of females there is no opposing force, in the shape of sexual selection, at work. It is, however, mere waste of time to enunciate Darvin's theory of sexual colouration, since my listeners are, one and all, doubtless better acquainted than I am with the writings of the most illustrious of naturalists. Wallace declines to accept Darwin's theory, and it seems to me that we have no option but to do likewise.

There is insufficient evidence (1) of feminine selection, and (2) that females select the most beautiful males.

In those cases in which females have been known to choose their mates, their selection has been very capricious.

Darwin, with characteristic fairness, quotes much evidence which goes to show that the female, when she does select, chooses, not the most beautiful, but "the most vigorous, defiant and mettlesome male."

Darwin quotes Mr. Tegetmeier as saying "that a gamecock, though disfigured by being dubbed, and with his hackles trimmed, would be accepted as readily as a male retaining all his natural ornaments."

There is some direct and, it seems to me, very conclusive, evidence which tends to disprove the Darwinian theory of sexual selection.

Take the case of the paradise flycatcher. It will be remembered that the male of this species does not attain his full plumage until after the moult of the fourth autumn. Nevertheless the male certainly finds a mate in his second and third years. In the face of this fact, it seems impossible to ascribe his subsequent white plumage to selection by the female.

Considering the great significance of the changes in the plumage of the male paradise flycatcher, it is surprising that the bird has not attracted a greater amount of attention. The life-history of the male birds of paradise appears to exhibit a similar phenomenon.

The life-history of these birds was not known when Darwin set forth his theory of sexual colouration. It was, however, a matter of common knowledge that the immature plumaged males of some species did breed. On this subject Darwin writes: "The fact of birds breeding in their immature plumage seems opposed to the belief that sexual selection has played as important a part, as I believe it has, in giving ornamental colours, plumes, &c., to the males, and by means of equal transmission, to the females of many species. The objection would be a valid one, if the younger and less ornamental males were as successful in winning females and propagating their kind, as the older and more beautiful males. But we have no reason to suppose that this is the case." Now, I submit that considering the comparative paucity of the white plumaged paradise flycatcher males, there is every reason to believe that in this species the young males are very successful in finding mates.

Wallace's theory is that the brilliant plumage and all the accessory ornamentation of male birds are the expression of surplus energy; that in most instances these characters have not been transmitted to the female, because it is important that she should be inconspicuous when sitting on the nest. The origin of the ornamental appendages of birds, writes Wallace, is to be found "in a surplus of vital energy, leading to abnormal growths in those parts of the integument where muscular and nervous energy are greatest. The continuous development of these appendages will result from the ordinary action of natural selection in preserving the most healthy and vigorous individuals, and the still further selective agency of the sexual struggle in giving to the very strongest and most energetic the parentage of the next generation.........In many groups in which this superabundant energy is at a maximum, the development of dermal appendages and brilliant colours has gone on increasing till it has resulted in a great diversity between the sexes, and in most of these cases there is evidence to show that natural selection has caused the female to retain the primitive and more sober colours of the group for the purposes of protection."

Wallace is able to adduce much evidence in favour of this theory, and his writings on the subject doubtless form a most valuable contribution to our knowledge of sexual dimorphism ; but it is, I venture to say, absurd to pretend that the theory offers a complete explanation of the phenomena in question.

In the first place, it fails to explain why some species are sexually dimorphic as regards plumage, while some are not.

Were all birds which nest in holes or construct covered nests sexually monomorphic as regards plumage, and were all those which build open nests, and of which only one sex performs the work of incubation, sexually dimorphic, then, Wallace's theory would explain everything. The need of protection of the sitting bird would of course account for its duller plumage.

Unfortunately for Wallace, many birds which nest in holes are sexually dimorphic, while many which nest in the open, and of which only one sex performs the duties of incubation, are sexually monomorphic. Further, there are some sexually dimorphic species, which build open nests, and of which both the male and female birds sit alternatively on the eggs. Darwin mentions the case of *Pyranga æstiva*, one of the most splendid birds in the United States, where the male is vermillion, and the female light greenish brown. As Darwin remarks, "if brilliant colours had been extremely dangerous to birds whilst sitting on their open nests, the males in these cases would have suffered greatly."

Again, the sexual dimorphism of many species is so slight, that I do not think that it can possibly be accounted for by the greater need of the female for protection.

Take, for example, the case of the common sparrow, or better still, since the nest is built in more open places, the rufous-backed sparrow (*Passer pyrrhonotus*). Is it possible that the slight amount of sexual differentiation exhibited by the species can render the female so much less conspicuous when sitting on the nest as to render the dimorphism necessary ?

If we answer this question in the affirmative, how is it that female orioles, ioras, and minivets have been allowed to become so conspicuous ? If it be alleged that these birds build very carefully concealed nests, and the female can therefore afford to wear showy plumage, I would refer to the bulbuls. Both the white-cheeked and red-whiskered forms build open nests in the most exposed situations, such as a raspberry bush, or croton plant—yet the two sexes are alike and far more conspicuous when sitting on the nest than any cock sparrow would be.

Speaking of such slight sexual differentiation as that exhibited by sparrows, Darwin says " such differences in colour must be accounted for on the principle of some of the variations in the males having been from the first limited in their transmission to the same sex ; as it can hardly be maintained that these differences when very slight, serve as a protection to the female." If I have learned anything from studying nature, it is that minute differences of colour are of very small importance to a species.

If every slight variation in the shade of its plumage appreciably affected the chances of a bird in the struggle for existence, there would be none of that diversity of colour exhibited by individuals of the same species.

As conspicuous examples of species of which the individuals of the same sex vary greatly in colour, I may cite the common bee-eater (*Merops viridis*) and the Madras white-headed babbler (*Crateropus griseus*).

Then, again, many species which have similar habits and live in identical environments, exhibit very great diversity of plumage.

Wallace writes : " Mr. Darwin has taught us that natural selection cannot produce absolute, but only relative, perfection, and, as protective colour is only one out of many means by which the female birds are able to provide for the safety of their young, those which are best endowed in other respects will have been allowed to acquire more colour than those with whom the struggle is more severe."

With the first part of the above passage I am in entire accord, but I must most emphatically disagree with the last portion, if it mean that all birds tend to acquire bright plumage but only those which are best endowed for the fight for existence have been allowed to acquire it.

I do not believe that, when we see a dull hen-bird, we can assert that owing to the great severity of the struggle for existence, the bird has not been permitted to acquire bright feathers. It seems to me that some birds tend to vary in the direction of bright plumage while others do not.

The mynas are a very successful race of birds, and I do not think that it is in accordance with facts to say that the reason they are not so brightly clothed as kingfishers are, is that they would have perished in the struggle for existence had they been thus gorgeously arrayed. Nor do I think we are justified in saying that the mynas have not sufficient surplus energy for the formation of bright colours or accessory plumes.

Mynas, rather, are not brilliant birds as regards plumage, because they have not chanced to vary in the direction of bright feathers. When I use the words "chanced to vary", it must not be thought that I allege that variation is due to chance. I use the expression merely because the laws which govern variation have yet to be discovered.

As further proof of the comparative insignificance of colour I may cite the conspicuous crows and drongos, which build open nests, but which, nevertheless, flourish like the green bay tree.

It seems to me that in nature an ounce of good solid pugnacity is worth many pounds of protective colouration so far as the struggle for existence is concerned.

I do not believe that it is possible to find any one grand cause accounting for all sexual dimorphism. I think it more probable that there are a vast number of factors, working in different degrees on the various species, which have brought about these complex phenomena. Some of these factors have come to light, while others have yet to be discovered.

The direct action of the sexual organs on external appearance is, I believe, an important factor, and one to which sufficient attention has not been paid.

That the generative organs do affect the external appearance of an animal, is fully proved from the results of castration of various animals. Take the case of the distorted horns of castrated deer.

Again, many birds when kept in confinement refuse to breed and it not infrequently happens that such birds do not attain the full brilliancy of their plumage. "The male and female of the splendid scarlet ibis" writes Darwin, "are alike, whilst the young are brown; and the scarlet colour, though common to both sexes, is apparently a sexual colour, for it is not well developed with birds under confinement, in the same manner as often happens in the case of brilliantly coloured male birds."

I am of opinion that many of the differences in the plumage of the sexes are in some way correlated with the sexual organs.

As an example of what we may call correlative sexual colouration I may quote the fact that the inside of the mouth of the male hornbill (*Buceros bicornis*) is black, while that of the female is flesh-coloured. Darwin himself admitted that sexual selection could not account for the inside of the male hornbill's mouth being black, nor can we suppose that this blackness is due to superabundant vitality exhibited by the male.

Again, the knob on the base of the bill of the Chinese goose (*Anser cygnoides*) is larger in the male than in the female. As another example of correlative sexual dimorphism, I may mention the difference in the shape of the neck of the mare and the horse. Anyone with a little experience, if made to mount a horse blindfold, can tell when once on its back, from the shape of the neck, to which sex the animal belongs.

Then, again, there is the case of the condor, cited by Darwin. The iris of this bird is at first dark-brown, but changes at maturity into yellowish-brown in the male, and into bright red in the female.

As a rule the development of the sexual organs tends to produce, or at any rate to be concomitant with, increased brilliancy of plumage. There are, however, exceptions. Thus Darwin states of certain young woodpeckers, they "have the whole upper part of the head tinged with red, which afterwards either decreases into a mere circular red line in the adults of both sexes, or quite disappears in the adult females." This disappearance of a bright colour can only be explained on the Darwinian hypotheses, on the assumption that the tastes of the female are quiet, and that she has persistently selected the male who had but little colour on his head. In order to account for the colour of some species, Darwin has to suppose that the taste of the female has undergone a somewhat violent change. This of course is a gratuitous hypothesis totally unsupported by any evidence.

Sometimes females acquire at a late period of life " certain characters proper to the male." Darwin himself admits that this phenomenon cannot be explained by any kind of sexual selection. He gives examples, on pages 178-180 of Vol. II of the *Descent of Man.* He asserts that " the laws of inheritance can alone account for such phenomena." This is but another way of saying that we cannot explain the phenomena in question.

As is well known to everybody, some birds assume a nuptial garb at the breeding season. This I would attribute, not to the action of sexual selection, but to the direct effect of the organs of generation upon the general system.

In this connection the nuptial plumage of the heron tribe is most interesting. It is unnecessary to remind you, that in many of these birds, such as cattle egrets and paddy-birds, both sexes assume nuptial plumage.

Darwin thus expresses himself upon this subject—

" Some members of the heron family offer a still more curious case of novelty in colouring, having apparently been appreciated for the sake of novelty.

The young of the *Ardea asha* are white, the adults being slate-coloured ; and not only the young, but the adults of the allied *Buphus coromandus* in their winter plumage are white, this colour changing into a rich golden buff during the breeding season. It is incredible that the young of these two species, as well as of some other members of the same family, should have been specially rendered pure white and thus made conspicuous to their enemies ; or that the adults of one of these two species should have been specially rendered white during the winter in a country which is never covered with snow. On the other hand, we have reason to believe that whiteness has been gained by many birds as a sexual ornament. We may therefore conclude that an early progenitor of the *Ardea asha* and the *Buphus* acquired a white plumage for nuptial purposes, and transmitted this colour to their young ; so that the young and the old became white like certain existing egrets ; the whiteness having afterwards been retained by the young whilst exchanged by the adults for more strongly pronounced tints. But if we could look still further backwards in time to the still earlier progenitors of these two species, we should probably see the adults dark-coloured. I infer that this would be the case, from the analogy of many other birds, which are dark whilst young, and when adult are white; and more especially from the adult of the *Ardea gularis*, the colours of which are the reverse of those of *A. asha*, for the young are dark-coloured and the adults white, the young having retained a former state of plumage. It appears therefore that the progenitors in their adult condition of the *Ardea asha*, the *Buphus* and of some allies have undergone, during a long line of descent, the following changes of colour:—firstly a dark shade, secondly pure white, and thirdly, owing to another change of fashion (if I may so express myself), their present slaty, reddish, or golden-buff tints. These successive changes are intelligible only on the principle of novelty having been admired by the birds for the sake of novelty."

This is very magnificent but it partakes of the nature of a piece of special pleading rather than of science. If the nuptial plumage of herons can be explained only on the principle of novelty having been admired by the birds, then it is impossible to account for it.

It seems to me that the sexual dimorphism of the plumage of certain cuckoos can be explained only on the theory that the organs of generation affect the external anatomy of the bird in some unknown and not understood way.

These birds do not incubate their own eggs, hence there would seem to be no reason, so far as natural selection is concerned, why the female should not be arrayed in the same kind of plumage as the male.

Darwin would doubtless say that there is a reason, *viz.*, that the male must tend on account of the tastes of the females to secure bright plumage, even though it handicap them in the struggle for existence, whereas the females are under no such necessity.

Unfortunately for the Darwinian theory the sexual dimorphism displayed by some species of cuckoo is very slight. It would, I submit, be absurd to believe that these slight sexual differences are due to the preference of the females for showy males.

In some cuckoos, then, it would seem that sexual dimorphism is due, neither to sexual selection, nor to excess of vitality on the part of the males, but is rather correlated in some unknown way with the generative organs.

The sexual dimorphism of the koel is possibly to be explained in a different manner. It will be remembered that these birds victimise crows. Crows seem to be aware that the koel is an enemy, for they never lose an opportunity of attacking the male bird. But, unless my memory serves me false, I have never seen a crow chase a female koel. Is it a fact that it is only the male koel which is detested by the crows? Do these latter fail to recognise the female as one of the same species? If so, the sexual dimorphism in this case is easy to account for. It is important that the male should be conspicuous in order to attract the attention of the crows and lure them away, while the female cuckoo deposits her egg. Young koels, when first they acquire feathers are black, presumably in order that their foster parents may mistake them for young crows. Later they assume the mottled plumage of the adult female, presumably in order that the crows shall not recognise them as their arch-enemy, hence the wonderful immunity from attack which young koels seem to enjoy.

In the case of cuckoos which victimise small, helpless birds such dimorphism is unnecessary for the welfare of the species, and so must, I think, be attributed to the influence of the sexual organs.

This brings me to a point which I would venture to emphasise, *viz.*, that not one but many causes have operated to cause external sexual dimorphism. The sexual dimorphism of one species is to be accounted for in one way, and that of another in an altogether different manner.

It is probable that that form of sexual selection whereby the most pugnacious and mettlesome males secure the most wives has contributed largely to the sexual dimorphism of polygamous species, in which the dimorphism is often so very marked. But the fact that the paradise flycatcher is monogamous shows that it is possible to ascribe too much importance to this factor.

Then, again, it is tolerably certain that in the case of birds sitting on open nests, natural selection has tended to keep the general hue of female birds dull and inconspicuous.

But there is, I think, a tendency to overrate the action of natural selection in this respect.

While considering the question of sexual colouring it is important to remember that the struggle for existence waxes exceedingly fierce among the young of a species. The mortality among young birds even after they are fully fledged, is enormous. When a bird has attained the age of sexual maturity, the odds are in favour of its surviving long enough to give birth to a family. Now, in most species, the male does not acquire his full plumage until he is ready to breed. This is precisely what we should expect if these colours and appendages are in some way or other connected with the sexual organs.

The mere fact that they appear so late allows them to be developed to a greater extent than they could possibly be were the young born like the adult.

I am aware of the unsatisfactory nature of this paper in that its tendencies are mainly destructive. Throughout it I have tried to destroy, but have made no attempt to create. I can offer no hypothesis in place of those which I seek to disprove. To say that sexual dimorphism in a bird's plumage is in many cases due to some occult action of the sexual organs, is, I am aware, no explanation. If we accept the view herein enunciated we have to admit that in some species the sexual organs exercise little or no effect on the external plumage, while in others the effect is very great indeed. Again, in some the effect is but slight, while in a few cases the effect is considerable, but of short duration. Why this should be, we do not know. But, if I am able to give no explanation of the phenomena under consideration, the theories of Wallace and Darwin display the same defects. The former makes no attempt to discuss isolated phenomena; it is merely a rough generalisation. The theory of Darwin deals with details, but in a most unsatisfactory manner. Let me, for example, quote Darwin's explanation of the fact that the young of the scarlet ibis are brown while both the adults are red. It is as follows: "When the adults are brightly coloured, we may conclude that such colours have been acquired through sexual selection by the nearly mature males; but that . . . . . . the transmission, though limited to the same age, has not been limited to the same sex." When we ask why the one limitation and not the other, the theory of sexual selection remains silent.

NOTE ON SEXUAL DIMORPHISM.

By L. C. H. Young, B.A.

In criticising Mr. Dewar's paper, I would like to say in the first place that he gives a much wider significance to the term than is generally accepted. The difference in the necks of a mare and a horse would not ordinarily be described by the term, any more than the average difference in breadth of shoulders in man and woman. By sexual dimorphism is generally understood the presence in one sex of some abnormal character which, if man did not know to the contrary, might lead him to suppose they were different species. The point may be easily illustrated by the two best known species of Felis. In the tiger there is no sexual dimorphism, although the sexes are abundantly distinct in average measurements ; the mane of the male lion is, however, a clear instance of the phenomena under discussion.

Sexual dimorphism is one of the largest and most difficult questions in the whole of Biology, and it is as impossible to deal with it properly in one paper as in ten minutes criticism. Moreover, it is found in all but the lowest orders of creation, and although I would not suggest that the same laws necessarily govern it in all, it only tends to confuse us to try and deal with it in one class to the exclusion of others.

An enormous amount of literature has been written on the subject, and in so far as Mr. Dewar is criticising Darwin's theory of sexual selection, he is whipping a dead horse ; for no one, I think, accepts this one of Darwin's theories at present except in a limited number of cases as a working hypothesis for want of a better. But we must not make the mistake of regarding Wallace's theory as contradictory to it. One regards the question from a physical and the other from a metaphysical point of view.

Granted that abnormal growths, colours, etc., take place during the breeding seasons they are more likely than not to show themselves at these centres of muscular and nervous energy which are nearest the seats of excessive vitality, *i.e.*, the head, lungs, and caudal regions. But this does not answer the question *why*.

Of the much that has been written in answer to this question "why" only two theories are important—one is Darwin's that they are acquired because they are beautiful, while the other side maintain that they are of the nature of a hereditary diseased growth or hypertrophy resulting in almost every case from some habit, generally that of fighting, characteristic of the males during the breeding season. This of course begs the whole question whether characters acquired during lifetime can be transmitted to descendants, but there is no time to discuss that now, or even the theory itself, in any detail. Suffice it to say that, if the hypotheses are granted, it is quite wonderful how the theory fits in with the known facts, and especially in cases where the dimorphism takes a peculiar direction it has generally been found that the creature has some peculiar method of fighting, etc., affecting the hypertrophied region. Stags' horns of course give a conspicuous example of the theory, while cock's combs and hollow-horned ruminants are instances where the character has been partially transmitted to the other sex also.

Pressed to extremes, however, the theory becomes ridiculous, as when it is sought to explain the hairy chins of men by the supposition that, in primal savagery, men were in the habit of biting each other's chins when fighting.

It is no criticism of either this or Darwin's theory to ask why it does not exist in all animals, because both theories presuppose an excess of males over females or polygamous habits which amount to the same thing ; as a matter of fact among almost all vertebrates where sexual dimorphism occurs, this is known to be the case.

Mr. Dewar cites the case of kingfishers and mynas, and asks why, according to Darwin, mynas should not be the more brilliant of the two. But he presupposes that brilliant colours are more difficult to acquire than sombre ones, which in the present state of our knowedge—or ignorance—is not justifiable. The colours of the myna's English cousin—the starling—would, one might suppose, be extremely difficult to acquire, although the general result is quite sombre.

There are many isolated cases of dimorphism for which special explanations can be offered as in the case of the New Zealand bird, the two sexes of which invariably feed together—one having a beak suited for boring holes in rotten trees, and the other for scooping out the grubs.

But I would maintain that the majority of cases among vertebrates at least must be explained by the relative incidence in particular cases of a number of laws or tendencies of which I think the following are the four chiefest :—

(1) The natural tendency of like to produce like.

(2) The natural tendency of the sexes to be unlike.

Not sufficient emphasis is laid on this point. The whole course of Natural History—by which I mean the history of the growth of creation from the most primitive forms to the highest—is almost as much a history of the specialisation of the functions of the sexes as of specific structures.

Without going into detail one need only refer to those organisms of which there is only one sex, to the next series where the two sexes are partially developed, but where parthenogenesis is still the rule and on to the higher forms in which the sexes gradually become more permanent and parthenogenesis rarer.

(3) The natural tendency of every creature to protect itself from its enemies, either by acquiring weapons of offence or defence or by superficial protective colours or structure.

(4) The natural tendency of the males of all species where rivalry exists among that sex to disregard (3) in a greater or less degree during the breeding season, when characteristic modifications, the result of pugnacity or sexual admiration or other cause have a chance to come into play.

I think the action of these four tendencies on the blood, etc., of the males, excited by the procreative instincts, will account in a general manner for the facts.

The latter part of Mr. Dewar's paper does not call for much comment as regards the main theory under discussion. I would merely remark as regards the assumption of a white garb by certain birds during the breeding season, that white is not a pigment* but the absence of it and the concentration of the vital energies in another direction is just as likely to cause an absence of pigment a excessive vitality in other species might produce abnormal pigment.

L. C. H. YOUNG.

NOTE ON SEXUAL DIMORPHISM.

By Captain W.G. Liston, I.M.S., M.D., F.R.S.E.

I listened with much pleasure to Mr. Dewar's paper on sexual dimorphism and cannot refrain from making a few remarks thereon, especially in view of Mr. Young's criticism of the paper.

I feel constrained to believe that were Darwin still alive he would no longer attribute sexual dimorphism to sexual selection. Already before his death he saw that he had not paid enough attention to the part played by use and disuse, environment, etc., in modifying the order of Nature.

Mr. Dewar seems to me to be on the right track when he insists on the importance of the organs of generation as a factor in the development of sexual dimorphism. Indeed, I think, we must take a broader view than either Darwin or Wallace did, and consider sexual dimorphism as a phenomenon based on the fundamental idea of sex.

When we contemplate the universe as a whole, we are made aware of the action of two opposing principles. Newton established the law of motion that to every action there is an equal and opposite reaction. The naturalist well knows that plants break up the carbon dioxide gas given out by animals, appropriating to themselves the carbon and letting free the oxygen, which can again be used by the animals. Here the plants break down what the animals have built up. Again, plants build up from simple inorganic elements, complex protoplasmic molecules which furnish food for herbivora, and after assimilation by them are given back by excretion as simple inorganic bodies which in their turn serve as food for the plants. In this instance animals break down bodies which the plants have built up. In the chemical and physical world the great law of the conservation of energy teaches us that while there may apparently be a breaking down there is at the same time a building up. The familiar example of the burning candle will call to mind what I mean. Indeed, wherever we look there is a breaking down and building up process going on—there is katabolism associated with anabolism.

I believe that it was Thomson and Geddes who first pointed out that the essential difference in the sexes depends on the fact that the male element has always katabolic tendencies, while the female element has essential anabolic proclivities. They expressed the contrast in the sexes as an antithesis between a relative anabolic and a relative katabolic preponderance in the protoplasmic life of the creature. They directed attention to the large size and more sluggish nature of the ovum and the smaller size and more active nature of the sperm; these are essentially anabolic and katabolic features. For the fertilisation of a single ovum a single sperm cell is only necessary; but in the process many sperm cells (often thousands) are involved, all, save the single necessary one, are dissipated, broken up, and lost. The katabolic tendency in the male element is very marked in this instance. Males essentially dissipate energy, females conserve it. Now we all know how important a relation exists between the generative or sexual and the vegetative cells. Stimulation of the former reflects itself in the latter. It is undoubtedly this katabolic stimulation of the vegetative cells, communicated through the male generative cells during the rutting season in certain animals, which makes the males so fierce, energetic, and destructive. The katabolic stimulus communicated to the vegetative cells, through the male generative cells may be dissipated in various forms of energy—*e. g.*, excessive growth, excessive bodily and nervous activity, and, as I hope to show, excessive brilliancy of colour.

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* In writing out my notes for the Journal I, of course, accept the Chairman's correction that where I used the word "colour" here I meant "pigment."

This katabolic stimulus of the male generative cells on the vegetative cells is the fundamental cause of sexual dimorphism.

This idea of sexual dimorphism enables us to understand why castration is followed by cessation of growth of horns and other structures characteristic of the male, and how animals with the characteristic male features little developed are essentially more feminine in their nature.

When we come to consider colour dimorphism I think the Chairman has drawn attention to an important fact which has to be kept in mind. He drew Mr. Young's attention to the fact that white was a colour—indeed a combination of all colours—and black is no colour. Yet the white colour of a feather is essentially due to the absence of pigment, while a black feather contains much pigment. A knowledge of the chemical constitution of the animal pigments, I believe, will not help us much to solve the question of colour differences in birds. The solution of the colour problem is more likely to be found in a more intimate knowledge of the physical laws affecting colour than in a knowledge of the chemical constitution of the coloured bodies. Let me instance a single chemical substance which shows a distinct colour dimorphism. The red iodide of mercury, when heated, is volatilised and may be condensed on a glass plate as a yellow crystalline crust consisting of rhombic plates. When this is rubbed or even scratched, an immediate change takes place, the rhombic plates becoming broken up into octohedra while the colour at the same time alters from a yellow to a brilliant scarlet. Here the chemical constitution remains the same but the colour has altered on account of physical laws.

The brilliant colours of male birds, especially that beautiful play of colours often seen on their heads and necks, is probably due to microscopically minute ridges and grooves on the feathers which reflect and retract the light and so cause the rainbow-like show of colours. These ridges and grooves are an exaggerated growth, the result of the stimulus conveyed to the vegetative cell from the male generative cells. The excessive brilliance of colour of male birds is essentially due to their sexual katabolic tendencies, that feature of all male animals which results in the dissipation of energy. Fortunately, other laws come into play which prevent the waste of energy; in this instance, the energy is conserved in the formation of those wonderful microscopic ridges and grooves which give brilliancy to the feathers of male birds. I will not attempt to explain why the energy should be conserved in this particular manner, but I feel that it has been done for some useful purpose which will best be understood by those who have made a special study of birds; perhaps, however, it is only another example of that beauty in design which we see in all nature.

In conclusion, may I hazard an explanation of the unusual frequency of white feathers in male birds? You are aware that in a frog there are pigment cells in the skin which are capable of contracting and relaxing. At rest they are relaxed and the frog assumes a dark colour. During stimulation they are contracted and the frog assumes a light colour. Now this power over pigment cells in the skin is exemplified to a greater or less extent in all animals. May it not be possible that the katabolic stimulus of the male generative cells, in the case of the birds, has led to a contraction of the pigment cells. This contraction maintained for long periods would end, through the operation of the law of disuse, in first the atrophy and later the complete disappearance of pigment, a white colour would thus be produced.

Coming now to consider Mr. Young's remarks on Mr. Dewar's paper I cannot agree with him that Mr. Dewar has given a wider significance to the term sexual dimorphism than is generally understood. Mr. Young's definition is very inexact and eminently non-scientific. In the term sexual dimorphism must be comprised all those differences which constantly distinguish the males from the females in any one species. The subject, Mr. Young rightly remarks, is a difficult one to discuss in a single paper chiefly because of its extensive application to the whole of the animal and vegetable kingdom, even I maintain to the lowest forms of life. Such a widely spread difference must essentially rest on a great fundamental law operating in all cases. In this respect my opinion differs entirely from Mr. Young. Moreover, I believe, it may be advantageous to study this law in the single specialised class of birds, especially if the study is made from an intimate knowledge, a specialist's knowledge, of the class; a knowledge not obtained from museums and books alone but from a study of the birds in Nature. Such a special study prevents the tendency to arrive at generalisations which, if founded on incomplete knowledge of details, are sure to mislead.

I fail to understand Mr. Young's remark that "granted that abnormal growths, colours, etc., take place during the breeding season they are more likely than not to show themselves at those centres of muscular and nervous energy which are nearest to the seats of excessive vitality, *i.e.*, the head, lungs, and caudal regions. But this does not answer the question why."

I was not aware that the head and lungs and tail were endowed with excessive vitality. As I have already remarked, the katabolic stimulus of the male generative cells on the vegetative cells is the fundamental cause of sexual dimorphism. The energy which results from this stimulus may reveal itself in excessive bodily or nervous activity or in brilliancy of colour. But while in this way energy is set free it is never wasted, it is conserved, and I believe always conserved to some useful purpose. To every action there is an equal and opposite reaction. The reaction checks waste and diverts the energy into useful channels. Hence it comes about that in opposition to the katabolic tendencies of the male, other subsidiary laws are called into play, *e. g.*, the law which maintains that useless structures and organs disappear and atrophy while useful structures and functions are developed. But even this law is limited by other laws which check too great specialism. The brain of man for example is a most useful organ, and it would be theoretically advantageous to develop it to a maximum extent, but other factors prevent this specialising. Without a well-developed body the brain becomes useless. *Mens sana in corpore sano* is eminently true. A tool without the hand to work it is no good. One law reacts against another law so that extremes are prevented. It would be quite impossible for me at present to consider the many laws that are thus called into play. I cannot believe that the four tendencies as Mr. Young has called them, suffice to explain the facts. The fundamental reason for sexual dimorphism lies in the fact that the male has katabolic tendencies while the female has anabolic proclivities, and these tendencies are prevented from developing into extremes by the operation of many other laws, the laws so called into play differ in individual instances; a knowledge of these laws will answer Mr. Young's question why? The answer will not be the same in every case, and it can only be made by a special study of individual groups, such as Mr. Dewar has at present attempted in the case of birds.

WM. GLEN LISTON, M.D., F.R.S.E., CAPTAIN, I.M.S.

REPLY TO CAPTAIN LISTON.

BY L. C. H. YOUNG.

I cannot avoid making some reply to Captain Liston because he seems to have misunderstood in some respects the drift of my remarks.

In the first place as to the definition of "sexual dimorphism," I did not intend to make any definition but merely to explain in an untechnical manner that discussions on sexual dimorphism were generally confined to the explanation of what naturalists term "secondary sexual characters," and these are certainly the only ones which Darwin and Wallace discuss.

If we include in it those differences which must exist in every species as being essential to the sexual relation we are getting outside the subject discussed in Mr. Dewar's paper altogether.

He criticises my expression "Excessive vitality," and no doubt I expressed very loosely and in part inaccurately what I meant in an endeavour to be intelligible to a mixed and untechnical audience.

I intended merely to state Wallace's theory that the catabolic stimulus will act most at the centres of muscular and nervous energy named during the period of salacity.

Captain Liston has given us very lucidly the physiological explanation of this and here we are in entire agreement.

But in my remarks I expressly took for granted this theory as the cause "how" these characters came into existence, but stated that it did not answer the question "why," *i. e.*, why these growths, colours, etc., take the form they do in particular cases.

It is this "why" that Darwin sought to answer by sexual selection.

Captain Liston cannot explain the "why" except as another example of that beauty in design which we see in all nature. That it is an example of the beauty we find in all God's handiwork I quite agree, but this does not answer our question.

Captain Liston says he is in entire disagreement with me, when I said that many individual cases would require special explanation and cited the case of the Huia in New Zealand, but he is evidently still thinking of the "how" while I was speaking of the "why."

With regard to his remarks on colour we are in substantial agreement, and I need occupy your time no further.

NOTES ON THE BIRDS OF CHITRAL.

(*October* 1901 *to October* 1902.)

BY CAPT. H. T. FULTON, D.S.O.

(*Read before the Bombay Natural History Society on* 16*th June* 1904.)

The notes from which this article is compiled, were collected during the "garrison" year, 15th October 1901 to 15th October 1902.

Information gathered during so short a period cannot be considered in any way to be full. I have been unable to find any previous note on the subject, with the exception of an article published by Captain MacMahon, C.S.I., C.I.E., F.Z.S. ("Notes on the Fauna of Chitral") printed in the Journal, Asiatic Society of Bengal, Vol. LXX, Part II, No. I of 1901.

This list will, therefore, I trust, be found useful to others who may wish to take up the subject during their stay in the district.

The bird-life of Chitral is most interesting on account of its variety, which is due not only to the varied topographical character of the country, but also to its position.

I give a description of the country which is only intended to convey a rough idea of its character.

Chitral is a long narrow triangular strip of country, and is the basin of the head waters of the river variously known as the Mastuj, Chitral and Kunar. The country is bounded on the north-west by Wakhan, on the west by Kafiristan, on the south-east by Dir and on north-east by Yasin. The river rises in the north-east and flows in a south-south-westerly direction, passing out of the country at its south-western boundary and flowing on through Afghanistan, joins the Kabul River.

There are several large streams flowing into the river, of which the Arkari meets it a few miles above Chitral and is the most important, and the Turikho and Shishikho are also to be noted.

The valleys are narrow and the mountain sides steep.

The elevation of the country above sea-level varies from 25,500 feet at Tirach Mir to about 3,600 feet where the river passes out of the valley. The lowest pass into the country is about 10,000 feet.

Roughly a line drawn east and west through the village of Chitral divides the country into the wooded (south) and treeless (north) portions. The wooded portion is mostly clothed with fine deodars up to an elevation of about 13,000 feet, the poorer ground being covered with holly.

The treeless portion is bare, with the exception of patches of birch and a small stunted willow and fruit-trees in the orchards.

Parts of the treeless portion are quite destitute of anything except small herbs, more especially that portion which is for a great time of the year under snow. These parts, however, are covered with a most luxuriant herbage immediately the snow melts, and form the summer grazing grounds on which finches, larks, pipits and buntings abound.

The valley is one of several parallel routes of the great migratory highway and is the cause of there being—

(1) Large numbers of certain species present for longer or shorter periods during certain seasons.

(2) Stragglers found throughout the year, probably the sick and the lame left on the roadside.

The country is also visited by certain species that either leave the north to winter in warmer quarters or *vice versa.*

During my short stay in the country I was only able to cover a small portion of the district. These notes are confined entirely to the birds found in those parts visited, which were roughly—

(1) The valleys on the right bank below Chitral.
(2) The Shishi Koh and the valleys on the left bank below Drosh.
(3) The main valley as far as Shost.
(4) The Turikho Valley.
(5) The range between the main valley and the Turikho.

With two exceptions all the birds are identified from skins.

I have to thank Mr. E. Comber for kindly checking the identification of the birds I sent him, and also for sending to the Natural History Museum, South Kensington, some 30 species which I was unable to identify or which we were doubtful of.

I have also to thank Dr. Sharpe and the authorities at the South Kensington Museum for their courtesy in enabling me to identify the above birds.

The numbers and nomenclatures are in accordance with Oates' and Blanford's Birds of British India.

ORDER I.—PASSERES.

Family *Corvidæ.*

(4) CORVUS MACRORHYNCHUS.—The Jungle-Crow.

This species is common all the year at the lower ranges (4,500 feet) and ascends the valleys to 11,000 feet in summer. It is very common round Drosh Fort all the year. I saw it at Madaglasht and in all the lower valleys, but not up the river above Chitral.

(9) CORVUS MONEDULA.—The Jackdaw.

A pair of these were obtained at Drosh—a male in February and a female in May. Another pair were seen in June; no other birds were noted. Possibly there are more further south in the wooded valleys and in Kafiristan.

(10) PICA RUSTICA.—The Magpie.

Very common on cultivated land in the upper valleys of Chitral. In December I saw one in Aiyon village (4,500 feet), and in June and July at Khot (10,000 feet), Madaglasht (14,000 feet), Dizg (8,000 feet).

(24) GARRULUS LANCEOLATUS.—The Black-throated Jay.

Very common all the year throughout the wooded valleys of Lower Chitral from 5,000 feet to 10,000 feet.

(28) NUCIFRAGA MULTIPUNCTATA.—The Larger-spotted Nutcracker.

I obtained only one specimen (female) in the Pattison Valley, 7,000 feet, and no others were seen. This bird is probably common in Kafiristan.

(30) PYRRHOCORAX ALPINUS.—The Yellow-billed Chough.

Very common. In winter they come down as low as 5,000 feet, and in summer their highest elevation is 16,000 feet. I noticed none below Drosh and none north of the head of the Turikho Valley-Shost Line, and none on the east side of the valley, nor in Yasin.

The feet are red (Blanford) usually, but in two specimens, both female, the feet were almost as black as the feathers.

(31) PARUS ATRICEPS.—The Indian Gray Tit.

These birds are very common in the wooded valleys of Lower Chitral and also in the orchards of the upper valleys as far north as Sanoghar. In summer they are found at elevations of 12,000 feet. I noted two nests, both in holes in walnut trees; one at Maroi, 25th June and one at Reshan, 26th June. In both cases the young were well fledged.

They were very common in the Bimboret Valley in March and April.

(37) ÆGITHALISCUS LEUCOGENYS.—The White-cheeked Tit.

Present throughout the year in the wooded valleys of Lower Chitral. They are very numerous and were found on the same date at 6,000 and 12,000 feet. (April.)

(44) LOPHOPHANES MELANOLOPHUS.—The Crested Black Tit.

Very common from 5,000 to 12,000 feet in the wooded valleys.

(47) LOPHOPHANES RUFINUCHALIS.—The Simla Black Tit.

Very common from 5,000 feet upwards to 12,000 feet in the cedar forests.

(N. S.) CYANISTES TIANSCHANICUS.

This is an entirely new species recorded within Indian limits, which, I think, may well be called the Chinese Blue-tit.

I obtained only five specimens, but there were any number of birds about.

The only locality in which they were observed was on the river bed at Shost, 10,000 feet, in July, where there were numbers in the dense scrub of stunted willow, juniper and birch.

They are very like the European *Parus cœruleus*, but without the blue head and nape, and the yellow of the under parts is less bright in the full-grown birds and brighter in the young.

Dr. Sharpe has promised to send me a description of this species which will be published in a later number.

Family *Crateropodidæ*.

(91) TROCHALOPTERUM SIMILE.—The Western Variegated Laughing-Thrush.

Very common in the lower wooded valleys up to 6,000 feet throughout the year.

This is one of the birds the Chitralis "hawk," and they require quick hawks to catch them before they get into cover.

(99) TROCHALOPTERUM LINEATUM.—The Himalayan-Streaked Laughing-Thrush.

Even more common than *Simile* and usually found in the same localities but at higher elevations.

(187) MYIOPHONEUS TEMMINCKI.—The Himalayan Whistling-Thrush.

Common in pairs throughout Lower Chitral. In winter at 5,000 feet and in summer up to 11,000 feet.

(269) HYPSIPETES PSAROIDES.—The Himalayan Black Bulbul.

A summer visitor, arriving in the beginning of April. Common in the lower valleys.

(284) MOLPASTES LEUCOGENYS.—The White-cheeked Bulbul.

A visitor during the summer, arriving in March and leaving in October. Very common at elevations up to 7,000 feet, in the wooded valleys.

(In October this was the commonest bird in the *Dir* Valley.)

Family *Sittidæ*.

(320) Sitta kashmirensis.—Brook's Nuthatch.

Very common in the deodar forests on the dividing ranges between Dir and Chitral, and Chitral and Kafiristan, at elevations up to 11,000 feet. It is found as low as 6,000 feet in the winter. At that season they are most common on the walnut trees.

(323) Sitta leucopsis.—The White-cheeked Nuthatch.

This nuthatch is very common in the deodar forests at elevations of 7,000 feet in winter to 12,000 feet in summer.

Family *Dicruridæ*.

(327) Dicrurus ater.—The Black Drongo.

A summer visitor, arriving in the middle of April. Common in the lower valleys at low ranges, 5,500 feet being the highest altitude up to which any were observed. None were seen above Chitral.

Family *Certhiidæ*.

(341) Certhia himalayana.—The Himalayan Tree-Creeper.

A single specimen ♀ was obtained in August at 8,000 feet.

(348) Tichodroma muraria.—The Wall-creeper.

Common between October and April at 4,000 to 6,000 feet. They do not appear to breed in Chitral, as I saw none from April to September in any of the valleys, nor on the ridges up to 17,000 feet. Neither did I see any in Yasin in July.

(A few were seen in the *Dir* Valley in October.)

Family *Sylviidæ*.

(401) Sylvia althœa.—Hume's Lesser White-throated Warbler.

Three specimens were obtained in May at elevations of 5,000 to 7,000 feet.

(418) Phylloscopus humii.—Hume's Willow-Warbler.

Only two specimens were obtained—a male in April at 10,000 feet, and female in September at 6,000 feet.

Family *Laniidæ*.

(473) Lanius vittatus.—The Bay-backed Shrike.

Very common. A summer visitor, arriving in the beginning of May, and leaving towards the end of September. It frequents the lower valleys up to 6,000 feet.

(476) Lanius erythronotus.—The Rufus-backed Shrike.

Also a common summer visitor, arriving in the middle of April and leaving in September, ascending in June to elevations of 7,000 feet.

(477) Lanius tephronotus.—The Grey-backed Shrike.

I obtained only one specimen (female) at Drosh, 5,000 feet, on 8th April, and it is probable that my identification of the specimen was incorrect. It may however have been a stray bird in a flight of either of the other species *Lanius vittatus* or *erythronotus.*

(495) Pericrocotus brevirostris.—The Short-billed Minivet.

A summer visitor, arriving in the middle of April. It is common at elevations of 7,000 to 10,000 feet in the wooded valleys of Lower Chitral.

They are certainly migratory, perhaps only locally, as I saw none in the valley even as low as 4,000 feet between October and April.

Family *Oriolidæ.*

(518) Oriolus kundoo.—The Indian Oriole.

Very common. A summer visitor, arriving in large numbers during the beginning of May and leaving in August and September.

The beautiful flute notes of this bird can be heard during the summer in every village orchard in the Shishi Koh and in the Chitral Valley as far as Sanoghar (8,000 feet).

Family *Sturnidæ.*

(532) Sturnus menzbieri.—The Common Indian Starling.

Common. A winter visitor. I was surprised to find none present even on the high grazing grounds at 15,000 feet during summer. It evidently migrates north, leaving in April and returning in October and November.

(542) Agropsar sturninus.—The Daurian Myna.

Only one specimen ♂ was obtained out of a flock of some 17 birds.

I got the specimen on 16th July at 11,000 feet at the head of the Turikho Valley. The previous known distribution within Indian limits is Burmah, so that its presence so far west is very interesting.

(544) Temenuchus pagodarum.—The Black-headed Myna.

Very numerous in summer. This species arrives during the end of April and beginning of May. None were seen above Chitral. Breeds at elevations of 5,000 and 6,000 feet.

(549) Acridotheres tristis.—The Common Myna.

Common at lower elevations throughout the year, and up to 8,000 feet in summer. I saw none in the upper valley above Chitral.

(558) HEMICHELIDON SIBIRICA.—The Sooty Flycatcher.

Only a single specimen, a male, was obtained at Drosh on 7th May.

Family *Muscicapidæ.*

(561) SIPHIA PARVA.—The European Red-breasted Flycatcher.

Common in the orchards of Lower Chitral during the winter and as late as the middle of April. It is quite possible that it is resident.

(589) ALSEONAX RUFICAUDUS.—The Rufus-tailed Flycatcher.

Two specimens only were obtained, both males, at 4,000 and 7,000 feet in April.

(598) TERPSIPHONE PARADISI.—The Indian Paradise Flycatcher.

A summer visitor, arriving in the beginning of May and leaving in August. Not numerous, and only ascending the valley as far as Drosh. None noted above 5,000 feet.

Family *Turdidæ.*

(610) PRATINCOLA MAURA.—The Indian Bush-Chat.

A resident. I obtained specimens among the scrub on the banks of the streams at 6,000 feet in the Bimboret nallah in February. I did not see them again till September, when large numbers arrived at Drosh, evidently migrating south. I believe they breed in the country.

(620) SAXICOLA OPISTHOLEUCA.—Strickland's Chat.

The commonest bird in the higher valleys in summer up to elevations of 10,000 feet and in the lower valleys in winter. There were numerous young birds as low as 6,000 feet in June and July.

(619) SAXICOLA CAPISTRATA.—The White-headed Chat.

I obtained specimens at elevations of 7,000 to 11,000 during May, June and July. In May I found a nest at 7,500 at the foot of a small shrub.

(630) HENICURUS MACULATUS.—The Western Spotted Forktail.

Not numerous. Present in winter at 4,500 to 6,000 feet in the wooded side valleys of Lower Chitral. I saw none in the summer, but they are probably present. I found them in the Pattison and Bimboret nallahs.

(638) CHIMARRHORNIS LEUCOCEPHALUS.—The White-capped Redstart.

I obtained only 5 specimens—two males near Shost, 11,000 feet, in July, and one male and two females at Baradam, 8,000 feet, in August.

(637) MICROCICHLA SCOULERI.—The Little Forktail.

Very common during the winter at elevations of 4,000 feet, among the scrub at the bottom of the valley between Drosh and Chitral.

In April they seemed to suddenly disappear, and no more specimens were obtained till August, when I got them at Baradam (8,000 feet). I cannot say I saw any of them plunging into the water as stated by Oates; in fact, most of the birds I saw seemed to stick more to the scrub, and seldom were near the water like *Henicurus maculatus*.

(644) RUTICILLA RUFIVENTRIS.—The Indian Redstart.

Very common at the head of the Turikho Valley above Ruah, between elevations of 10,000 and 14,000 feet, in July.

(645) RUTICILLA ERYTHROGASTER.—Güldenstadt's Redstart.

Common in winter along the rivers and streams as low as 4,000 feet (Drosh). They migrate to higher ranges towards the end of March, and by the first week in April none are to be found around Drosh.

I obtained one specimen (female) during the summer (25th July) on the Shajinali Pass, 14,000 feet.

(646) RHYACORNIS FULIGINOSUS.—The Plumbeous Redstart.

Common in the lower valleys in Chitral from 4,000 to 7,000 feet, in winter, and breeding in June as low as 4,000 feet (Drosh). I saw none above Chitral, nor did I see any above 7,000 feet, in summer.

(647) CYANECULA SUECICA.—The Indian Blue-throat.

Passes through on its way south during the latter end of September and beginning of October. The northern migration is probably in April, but I observed no specimens at that time.

The birds were obtained at Drosh, 4,000 feet.

(657) ADELURA CÆRULEICEPHALA.—The Blue-headed Robin.

Present throughout the year in the wooded valleys of Lower Chitral at elevations of 6,000 to 9,000 feet, according to season.

(677) MERULA ATRIGULARIS.—The Black-throated Ouzel.

A single specimen, a male, was obtained at 11,000 feet on 27th April.

(678) MERULA UNICOLOR.—Tickell's Ouzel.

Fairly common between 6,000 and 9,000 feet in April and May and probably all the summer, in the wooded valleys of Lower Chitral.

(691) PETROPHILA CINCLORHYNCHA.—The Blue-headed Rock-Thrush.

I only obtained one specimen at 7,000 feet on 5th May.

(693) PETROPHILA CYANUS.—The Western Blue Rock-Thrush.

Present throughout the summer at elevations of 5,000 feet to 10,000 feet. First noted in May at 8,000 feet, July 10,000, and September 5,000 feet. Not common.

(694) MONTICOLA SAXATILIS.—The Rock-Thrush.

Two specimens, both females, were obtained in September and October at 7,000 feet. The former with an egg.

(695) TURDUS VISCIVORUS.—The Missel-Thrush.

Common in the valleys of Lower Chitral. In winter it descends to 6,000 feet and in summer is to be found up to 13,000 feet.

A nest with 4 eggs was found at 12,000 feet on the 26th of April, and the tree, nest, and bird were covered with snow.

(709) CINCLUS ASIATICUS.—The Brown Dipper.

Not uncommon in the wooded valleys of Lower Chitral, throughout the year at 4,000 to 10,000 feet and upwards.

Family *Ploceidæ.*

(734) UROLONCHA MALABARICA.—The White-throated Munia.

A summer visitor, arriving about the middle of May and only found up to 4,000 feet in the valley.

Although it is stated that this sub-family is not migratory (*Fauna of British India*, Birds, Vol. II, page 181), this species certainly migrates perhaps only locally. There were none in the valley during winter and until the end of April, when large numbers arrived on the cultivated ground below Drosh.

Family *Fringillidæ.*

(740) COCCOTHRAUSTES HUMII.—Hume's Haw-Finch.

I only obtained two specimens of this species, both during the second week of May at Drosh. I am uncertain whether it breeds in the country, but am inclined to believe it does.

(754) PROPASSER THURA.—The White-browed Rose-Finch.

Only one specimen, a male, was obtained of this species in Pattison nallah at 9,000 feet (30th April).

(755) PROPASSER PULCHERRIMUS.—The Beautiful Rose-Finch.

This species arrives about the middle of April. All the specimens I obtained during April, and I saw none in the summer, and am not certain whether they breed in the country. They are very common during their stay and frequent the cedar forests at elevations from 6,000 to 10,000 feet.

(761) CARPODACUS ERYTHRINUS.—The Common Rose-Finch.

Common during July on the grazing grounds at the head of the Turikho Valley at elevations from 10,000 to 15,000 feet, where it probably breeds, and in winter at 5,000 feet around Drosh.

(762) Carpodacus severtzovi.—Severtzoff's Rose-Finch.

Only one specimen, a male, was obtained at Gharaghar, 13,000 feet, on 10th July. There were a good many about, but as I was pressed for time, I was unable to obtain more. They were on open grassy ground with large rocks scattered about, just below snow line.

(764) Erythrospiza mongolica.—The Mongolian Desert-Finch.

I obtained only a pair at the head of the Turikho Valley at 10,000 feet on 9th July. They probably breed in the country.

(764*a*) Rhodopechis sanguinea.

This species has not previously been recorded within Indian limits. I only saw two birds at Ruah in the Turikho Valley at 10,000 feet, and unfortunately was only able to obtain one specimen. It is a very fine large finch.

I do not think there can be any doubt that it visits the Indian region, by which I mean any part of the country south of the Hindu Kush. The birds were feeding on open grass land with scattered boulders.

(767) Carduelis caniceps.—The Himalayan Gold-Finch.

Very common in summer, but not resident in winter. Arrives in April in large numbers, and breeds in the country. It feeds on the seeds of thistles, etc., and is found chiefly on the higher grazing grounds up to elevations of 13,000 feet.

I watched a pair building in the Rah-Roshan Valley at 12,000 feet (20th July). The nest was placed in the fork of a small birch about 4 feet from the ground, and although incompleted was similar to that of the European Gold-Finch (*C. elegans*).

(768) Callacanthis burtoni.—The Red-browed Finch.

A summer visitor. All the specimens I obtained were shot in the deodar forests at 8,000 to 9,000 feet, during August.

(770) Acanthis brevirostris.—The Eastern Twite.

Fairly common on the high grazing grounds at elevations of 10,000 to 14,000 feet in July and August. I obtained a nest at 13,000 feet.

It was built in a wormwood plant at a height of some 6 inches off the ground. The nest was well made and constructed of the dried flower stems of a small yellow flowered vetch, lined with the seed-down of a stunted willow.

The eggs were 6 in number, averaging ·75″ × ·5″, of pale greenish colour, with a few small scattered spots, blotches and lines of reddish brown, more numerous at the thicker end.

I tried to catch the hen with a butterfly net, and as I did not succeed, I left the nest till next morning when I took the bird, nest and eggs.

(771) METOPONIA PUSILLA.—The Gold-fronted Finch.

Present throughout the year, but not numerous in the winter. Large numbers pass through Drosh in April.

I found a pair nesting in July at 12,000 feet at the head of the Turikho Valley, where they were fairly common among the birch and stunted willow.

(776) PASSER DOMESTICUS.—The House-Sparrow.

Not present during winter. They arrive from the plains about the beginning of April, breed in the country, and leave early in October.

They nest in the trees. In the Upper Chitral valley the nests were very common in holes in the cliffs.

Noted as far up the valley as Sanoghar (7,800 feet).

(778) PASSER HISPANIOLENSIS.—The Spanish Sparrow.

Passes through the country, not a resident in winter, and none observed in summer. Numerous in the middle of April, arriving later than the first arrivals of *P. domesticus*, and returning in October on their way to the plains.

(779) PASSER MONTANUS.—The Tree-Sparrow.

Present in large numbers throughout the year. They nest mostly in buildings from April to August at elevations of 4,000 to 7,000 feet. It will be seen that *P. montanus* and *domesticus* thus appear to change their breeding places. This is probably due to the former being in possession of the best nesting sites when the latter appear.

(780) PASSER CINNAMOMEUS.—The Cinnamon Tree-Sparrow.

Fairly common throughout the year at elevations of 6,000 to 8,000 feet in the wooded valleys of Lower Chitral.

In April I saw flocks of 50 and 60 birds in the Bimboret Valley. In May I saw an unfinished nest in the Pattison Valley at 8,000 feet, and another in June in a willow tree in the Shishi Koh at 7,000 feet.

This pretty little sparrow is evidently a good mimic. I heard one in the Bimboret Valley imitating the song of the Indian Grey Tit (*Parus atriceps*) to perfection.

(787) FRINGILLAUDA SORDIDA.—Stoliczka's Mountain-Finch.

This finch is very common in summer on the grazing grounds at elevations of 10,000 to 14,000 feet. I was surprised to see them in large flocks in July, with apparently no young birds with them. As I saw them in April and May at elevations of 6,000 feet they must nest during the end of May, and early part of June.

(788) FRINGILLAUDA BRANDTI.—Brandt's Mountain-Finch.

Numerous in Bangol at elevations from 13,000 feet and upwards in July. I saw them nowhere else.

(793) EMBERIZA STEWARTI.—The White-capped Bunting.

Very common in the valleys of Lower Chitral at elevations of 5,000 to 12,000 feet according to season.

(794) EMBERIZA STRACHEYI.—The Eastern Meadow-Bunting.

Very common at elevations of 4,000 to 14,000 feet throughout the country according to season. I saw numerous young birds just out of the nest in June and July, some at 9,000 and others at 14,000 feet.

(801) EMBERIZA RUTILA.—The Chestnut Bunting.

I only obtained a male in April in the Golan Valley at 7,000 feet.

Family *Hirundinidæ*.

(805) CHELIDON KASHMIRIENSIS.—The Kashmir Martin.

Common from April to October and evidently breeding in the country.

(808) COTILE RIPARIA.—The Sand-Martin.

Common from April to October.

(810) PTYONOPROGNE RUPESTRIS.—The Crag-Martin.

Appearing about the middle of April and remaining till October. Found at all elevations up to 13,000 feet.

(824) HIRUNDO RUFULA.—The European Striated Swallow.

Although I only obtained two specimens of this species, I believe it to be as common as the other species noted above. Both specimens (male and female) were obtained in April at 6,000 feet.

Family *Motacillidæ*.

(826) MOTACILLA ALBA.—The White Wagtail.

Present throughout the year at elevations from 4,000 to 10,000 feet according to season.

(829) MOTACILLA PERSONATA.—The Masked Wagtail.

Present throughout the year at elevations of 6,000 to 12,000 feet according to season. I obtained two fully fledged young at Ghazin (10,000 feet) on 27th July.

(832) MOTACILLA MELANOPE.—The Grey Wagtail.

I only secured one specimen, male, at the end of March at 6,000 feet (Bimboret).

(835) MOTACILLA BEEMA.—The Indian Blue-headed Wagtail.

Only one specimen (male) was secured of this species at Drosh on 19th April. They were however very numerous at the time, and were evidently passing through the country.

(838) MOTACILLA CITREOLOIDES.—Hodgson's Yellow-headed Wagtail.

I only saw a pair of this species, of which I obtained the male above Ruah (10,000 feet) on 9th July.

I have no doubt that it was then breeding.

(840) ANTHUS TRIVIALIS.—The Tree-Pipit.

There are, I believe, a few stragglers of this species present throughout the year at elevations of 5,000 to 12,000 feet according to season.

Family *Alaudidæ.*

(855) OTOCORYS PENICILLATA.—Gould's Horned Lark.

Present during the summer (July) at the head of the Turikho Valley at elevations of 13,000 feet and upwards. Probably present at lower ranges of the valleys of Upper Chitral during winter.

(859) MELANOCORYPHA BIMACULATA.—The Eastern Calandra Lark.

This lark is very plentiful during the end of February and beginning of March on its northward migration. I saw a Chitrali shooting large numbers of them at Drosh, bagging as many as a dozen at a shot. I did not note their return.

(860) ALAUDA ARVENSIS.—The Sky-Lark.

Fairly numerous throughout the year at elevations of 5,000 to 11,000 feet according to season. I obtained fully fledged young birds at 11,000 feet at the end of June.

(862) CALANDRELLA BRACHYDACTYLA.—The Short-toed Lark.

Large numbers of this species passed through Drosh during the first week of October on their winter migration to the south. I did not note their northward migration.

(864) CALANDRELLA TIBETANA.—Brook's Short-toed Lark.

Only two specimens—a male and female—were obtained, both at Sangoghar (8,000 feet), in May.

ORDER II.—EURYLÆMI.

ORDER III.—PICI.

Family *Picidæ.*

(946) GECINUS SQUAMATUS.—The West-Himalayan Scaly-bellied Green Woodpecker.

Common throughout the year in all the wooded valleys of Lower Chitral at elevations of 4,000 to 8,000 feet.

(961) DENDROCOPUS HIMALAYENSIS.—The Western Himalayan Pied Woodpecker.

Common in the wooded portion of Lower Chitral at elevations of 5,000 to 11,000 feet. They are very common in winter in the village orchards. I noticed a pair building in a dead deodar at the end of April at 11,000 feet.

(969) DENDROCOPUS AURICEPS.—The Brown-fronted Pied Woodpecker.

Fairly common in the wooded portion of Lower Chitral at elevations of 4,000 to 10,000 feet.

(1003) IYNX TORQUILLA.—The Common Wryneck.

I only obtained one specimen which was "hawked" at Resham (6,500 feet) on 19th May.

ORDER IV.—ZYGODACTYLI.

ORDER V.—ANISODACTYLI.

Sub-Order *Coraciæ.* Family *Coraciadæ.*

(1024) CORACIAS GARRULA.—The European Roller.

Passed through on its migration to the north in the beginning of May, remaining in the country for a week or so. Not noted on its return to the south. Possibly stragglers occasionally breed in the country.

Sub-Order *Meropes.* Family *Meropidæ.*

(1029) MEROPS APIASTER.—The European Bee-eater.

Arrives at the end of May. The majority pass through on their northward migration, and a few remain in the wooded valleys of Lower Chitral at elevations of 4,000 to 8,000 feet where they evidently breed. Probably returns to the south in October, but none were noted.

Sub-Order *Upupæ*. Family *Upupidæ*.

(1066) Upupa epops.—The European Hoopoe.

Not a winter resident. Arrives at the end of March from the south. I noted a pair at the head of the Turikho Valley in July at 14,000 feet. They are fairly numerous at lower ranges. Breeds in the country.

ORDER VI.—MACROCHIRES.

Sub-Order *Cypseli*. Family *Cypselidæ*.

(1068) Cypselus melba.—The Alpine Swift.

Common in summer at elevations of 5,000 to 16,000 feet. Arrives at the beginning of April and leaves in September. Breeds in the country.

(1069) Cypselus apus.—The European Swift.

Arrives in the beginning of April and leaves in September. Very common at elevations of 5,000 to 8,000 feet, and less common up to 14,000 feet.

ORDER VII.—TROGONES.

ORDER VIII.—COCCYGES.

Family *Cuculidæ*.

(1104) Cuculus canorus.—The Cuckoo.

Arrives during the end of March, and is fairly common in summer at low elevations. I also saw and heard them in the birch jungle at the head of the Turikho in July at 12,000 feet.

ORDER IX.—PSITTACI.

Family *Psittacidæ*.

(1141) Palæornis schisticeps.—The Slaty-headed Paroquet.

A summer visitor. The earliest noted arrivals were a flight of some 30 birds on 25th March flying strongly up the valley at a high elevation. They flew straight into a snow-storm, and evidently disliking the temperature wheeled about and flew down the valley at a good pace. I saw none above 7,000 feet.

ORDER X.—STRIGES.

Family *Asionidae*.

(1159) Syrnium biddulphi.—Scully's Wood-Owl.

This owl frequents the wooded valleys of Lower Chitral and is not very common. Its single hoot can be heard frequently at elevations up to 8,000 feet. As I obtained an egg from a female on 23rd March, it would appear that it breeds during March and April.

(1167) Bubo ignavus.—The Great-horned Owl.

I only obtained two specimens, both at Drosh (4,500 feet). One (a female) was caught in a starving condition in December.

(1173) Scops giu.—The Scops Owl.

Common in summer in the valleys of Upper Chitral and probably in Lower Chitral, although not noted.

ORDER XI.—ACCIPITRES.

Family *Vulturidæ.*

(1198) Neophron percnopterus.—The Egyptian Vulture, or Large White Scavenger Vulture.

As I did not skin any of this genus I am not certain whether this species or *N. ginginianus* is seen in the country during summer. Possibly both species will be found to visit the lower country. Not present during winter. They appear in March and remain till September, seldom mounting to any altitude above 7,000 feet.

Two nested in a small cave in the face of a cliff overhanging the river, and the female was sitting at the end of March. They are not very common.

Family *Falconidæ.*

(1199) Gypaëtus barbatus.—The Bearded Vulture, or Lämmergeyer.

Present throughout the year. Common around Drosh. During summer they ascend to high elevations. During winter they are found at lower ranges and can usually be seen about the Fort feeding on offal, etc.

(1208) Hieraëtus pennatus.—The Booted Eagle.

I only obtained one specimen (male) of this species, on 11th May, at Drosh, 4,500 feet.

(1230) Milvus melanotis.—The Larger Indian Kite.

Only one specimen (male) obtained, 16th April, at 6,000 feet.

(1232) Elanus cæruleus.—The Black-winged Kite.

Not present in winter. Arrives in April and is common in summer in the wooded valleys of Lower Chitral, and about cultivation.

(1233) Circus macrurus.—The Pale Harrier.

A single specimen ♂ obtained at Drosh, 4,500 feet, in April.

(1247) Accipiter nisus.—The Sparrow-Hawk.

A single specimen ♀ obtained in May at 8,000 feet.

(1260) FALCO SUBBUTEO.—The Hobby.

Only one specimen, a female, was obtained at Reshan (6,000 feet) in May.

(1265) TINNUNCULUS ALAUDARIUS.—The Kestrel.

Very common throughout the year at elevations of 4,000 feet and upwards according to season. While resting on a pass overlooking the Wakhan country, at an elevation of 18,000 feet, a pair of these birds crossed over from the Chitral side (July). They are very common round Drosh. In winter they are not in the least shy, allowing one to approach quite close to them and then only rising to alight a few yards further off. In summer they may be frequently seen hovering over the crops. They commence nesting in April.

ORDER XII.--COLUMBÆ.

Family *Columbidæ*.

(1292) COLUMBA INTERMEDIA.—The Indian Blue-Rock-Pigeon.

Common throughout the year in the valley of the Chitral river up to Shost (10,000 feet) and in some of the side valleys.

(1296) COLUMBA LEUCONOTA.—The White-bellied Pigeon.

The "Snow Pigeon" is not uncommon in summer at elevations of 11,000 to 14,000 feet at the head of the Shishi Koh and Turikho.

In the latter valley, although I was unable to find a nest, I believe the birds were nesting. (July.) (Also noted in Yasin. July).

(1305) TURTUR FERRAGO.—The Indian Turtle-Dove.

A common visitor to the valleys of Lower Chitral. Arrives during the second or third week in April, and leaves in August and September.

I noted what I believe to be birds of this species at the head of the Turikho Valley in July in the birch jungle at 11,000 feet.

(1307) TURTUR SURATENSIS.—The Spotted Dove.

Common in summer in the valleys of Lower Chitral at elevations of 4,000 to 8,000 feet. Not a winter resident. Arrives in April. Departure not noted.

(1309) TURTUR CAMBAYENSIS.—The Little Brown Dove.

Only one specimen, a male, was obtained on 18th April at Drosh. It is probably common.

(1310) TURTUR RISORIUS.—The Indian Ring-Dove.

Common in cultivated districts, arriving in April from lower country. It is not present in winter.

ORDER XIII.—PTEROCLETES.

ORDER XIV.—GALLINÆ.

SUB-ORDER.—*Alectropodes.*

Family *Phasianidæ.*

(1334) PUCRASIA MACROLOPHA (*Var. castanea*).—The Koklas or Pukras Pheasant.

This fine pheasant is common on some of the heavily timbered mountain sides of Lower Chitral, *viz.*, Pattison, Asreth, and the valley behind Drosh Fort.

It is generally found above 7,000 feet, but ranges lower in winter. Specimens are very difficult to obtain owing to the dense nature of the ground they keep to. There are probably large numbers of them in Dir and Kafiristan. At the head of the Pattison valley their harsh cry can be continually heard in spring. It is also to be heard in the Asreth Valley. It is the call of the male that has led to the belief that the jungle fowl (*Gallus ferrugineus*) is to be found in the country. I made a special point of trying, if possible, to find the jungle fowl and have no doubt that none exist. All the camps at which the cry of the jungle fowl is said to have been heard, are far above the limit of elevation to which they are known to extend. It can be easily understood that the cry kok, kok, kok, kokras, or the plain kokras has been mistaken for that of the jungle fowl when heard at any distance. When however the call is once heard near at hand it cannot be possibly confounded with that of *G. ferrugineus.*

(1342) LOPHOPHORUS REFULGENS.—The Monal.

This beautiful pheasant is common on the wooded ridges of Lower Chitral. In winter they are found at elevations up to 10,000 feet and in summer still higher.

(1355) COTURNIX COMMUNIS.—The Common or Grey Quail.

Passes through the country during the end of April and beginning of May in small numbers.

A certain number stay in the country and possibly breed. They may, however, be only stragglers who have been unable to continue their migration.

I saw a pair at the head of the Turikho Valley in July at 14,000 feet.

(1370) CACCABIS CHUCAR.—The Chukor.

Very common throughout the year all over the country, ranging in summer up to 12,000 feet and perhaps higher, and in winter 4,000 feet.

I noted a hen with chicks in the Turikho Valley at 12,000 feet on 12th July and another at 6,000 feet on 27th July.

(1378) TETRAOGALLUS HIMALAYENSIS.—The Himalayan Snow-Cock.

Present throughout the year at elevations of 6,000 feet and upwards. The Snow-Cock is found at ranges as low as 6,000 feet near Drosh in March and April. They migrate to higher altitudes towards the middle of April, and are during summer to be found on the open country at 16,000 feet and perhaps higher.

They are shy and difficult to get, as they gradually make towards almost inaccessible points, and consequently when shot fall hundreds of feet, so that when picked up they are usually badly mangled. I saw two clutches of young birds between 15,000 and 16,000 feet on the edge of the snow line on 20th July. (Turikho.)

ORDER XV.—HEMIPODII.

ORDER XVI.—GRALLÆ.

Family *Rallidæ.*

(1405) FULICA ATRA.—The Coot.

Only one specimen obtained at Drosh (4,000 feet) 20th March.

ORDER XVII.—LIMICOLÆ.

Family *Charadriidæ.*

(1436) VANELLUS VULGARIS.—The Lapwing or Peewit.

A winter visitor, not numerous, but fairly common on the flat cultivated land along the river. Remains till late in May and some probably breed in the country.

(1437) CHETTUSIA GREGARIA.—The Sociable Lapwing.

Fairly common in the main valley during winter. Generally in small flocks of 4 or 5.

I also obtained specimens at the head of the Bimboret Valley on the swampy ground at 6,000 feet during April.

They were at Drosh at the end of May and probably breed in the country.

(1460) TOTANUS HYPOLEUCUS.—The Common Sandpiper.

Only one specimen, a male, was obtained at Chitral on 30th May.

(1461) TOTANUS GLAREOLA.—The Wood Sandpiper.

One specimen, a male, was shot at Drosh on 8th May,

(1462) TOTANUS OCHROPUS.—The Green Sandpiper.

Common in Lower Chitral along the river bank in March and April and beginning of May. I am certain they breed in the country although I obtained no eggs.

I found numbers of them at the head of the Turikho Valley at elevations of 9,000 to 14,000 feet in July.

(1471) TRINGA MINUTA.—The Little Stint.

Common in April and May along the river bed, evidently on their northward migration.

(1480) PHALAROPUS HYPERBOREUS.—The Red-necked Phalarope.

Only one specimen, a male, was obtained at Drosh on 14th September.

(1482) SCOLOPAX RUSTICULA.—The Woodcock.

Not numerous. Present throughout the year in the wooded valleys of Lower Chitral (5,000 feet).

Specimens were obtained in Utzun in January and May, Bimboret (6,000 and 7,000 feet) April, and Shishi Koh (7,000 feet), June.

Evidently breeds in the country.

(1484) GALLINAGO CÆLESTIS.—The Common Snipe.

Only a few noted at Drosh the third week in April on their northward migration.

(1486) GALLINAGO SOLITARIA.—The Himalayan Solitary Snipe.

Not common. One specimen was obtained in December at the mouth of the Shishi Koh (4,000 feet), two in the Bimboret Valley at 7,000 feet (March), a few others were also seen there.

In May I saw a pair in the Pattison Valley at 6,000 feet.

ORDER XVIII.—GAVIÆ.

Family *Laridæ.*

(1490) LARUS RIDIBUNDUS.—The Laughing Gull.

Only one specimen, a female, was obtained at Drosh on 9th March.

ORDER XIX.—STEGANOPODES.

ORDER XX.—TUBINARES.

ORDER XXI.—HERODIONES.

Sub-order *Ardeæ.* Family *Ardeidæ.*

(1555) ARDEA CINEREA.—The Common Heron.

A female was obtained on the 9th March at Drosh (4,000 feet) and several passed through at the end of March, flying north. I saw a pair at the junction of the Turikho with the Chitral River (7,000 feet) at the end of June.

(In October I saw a pair on the Panjkora River below Robat Dir.)

ORDER XXII.—PHŒNICOPTERI.

ORDER XXIII.—ANSERES.

Family *Anatidæ.*

Sub-family *Anserinæ.*

(1583) Anser indicus.—The Barred-headed Goose.

Although I did not see any specimens of this species in Chitral it is probable that it occurs.

This species breeds on the Shandur Lake which is just over the Chitral border, and I saw several tamed birds that had been taken as nestlings the previous year.

Sub-family *Anatinæ.*

(1592) Anas boscas.—The Mallard.

It passes through on its northward migration, beginning early in March and continuing till the end of the month, and on its return passage, beginning about the second week of September. This species does not winter in the country.

(1597) Nettium crecca.—The Common Teal.

Passes through to the north during March and first week in April in large numbers, and returns south about the beginning of October.

A certain number winter in the country.

(1599) Mareca penelope.—The Wigeon.

Passes north during March and first week in April, returning south in October.

Does not appear to be very numerous, nor does it winter in the country.

(1600) Dafila acuta.—The Pintail.

Does not winter. Passes north towards the end of February and March. The return south was not noted.

(1602) Spatula clypeata.—The Shoveller.

Passes north during March and the first week in April. The return migration was not noted.

ORDER XXIV.—PYGOPODES.

WATER-YIELDING PLANTS FOUND IN THE THANA FORESTS.

By G. M. Ryan, I.F.S. F.L.S.

(*Read before the Bombay Natural History Society on 29th Sept.* 1904.)

Calycopteris floribunda, commonly known as Ukshi in Thana, is one of the most interesting (if not the most interesting) scandent shrubs of the Thana District. In alluding to it as such, however, it is necessary to explain that this is not its habit of growth in all parts of India. In the "Flora of British India" it is described as "a diffuse dense shrub . . . . not at all scandent," but Sir Dietrich Brandis, in his "Flora of N.-W. Central India," and Mr. Gamble, in his "Manual of Indian Timbers," both refer to it as possessing a climbing habit.

In the Thana District it may be seen both as a diffuse shrub and formidable scandent one. When standing isolated in waste areas it seems to acquire the former habit in consequence of being lopped annually for fuel and tahal,* and when growing in the forest amidst large-tree growth it assumes a scandent form. Attention cannot help but being directed towards this interesting member of the vegetable world, especially at the commencement of the hot weather when in flower, for it then forms a most attractive plant. As a climber its pretty pale golden flowers bedeck the illuminated heights of a tree covering it, as it were, with glory, and as a shrub its pale golden inflorescence is even still more abundant and handsome. It has often been a surprise under the circumstances why *Calycopteris floribunda* has not been more utilized as an ornamental plant in gardens in Western India. Its climbing habit probably has been a barrier to its introduction, but this can easily be checked by yearly attention. A very fine specimen of the shrub exists in the hanging gardens on the Gibbs Road, Malabar Hill. Bombay, and Mr. W. S. Millard, one of the Honorary Secretaries of the Natural History Society, who is superintending the horticultural improvements at Malabar Point, states that specimens of this scandent shrub may be seen in Government House grounds there. The Ukshi, when a scandent shrub, ascends the bole of a tree in a characteristic manner, climbing from left to right. Having established itself in the forest in some spot not far from a tree it extends its leading shoot till it reaches the branch of an adjacent one. It proceeds to embrace the bole at first in several loose coils and then to stretch its leader out as if in search of a further exterior support, failing to find which it returns to the original bole and forms three or four constricting coils round it, continuing to adopt the left-to-right habit.

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* Tahal is the term used in the Thana District for the branchwood and leaves which are cut to provide wood-ash manure for the rice nursery beds.

Releasing its grasp again it succeeds by a series of wide curves or swoops to reach the illuminated heights of the crown. Here it commences to form a net-work of branches, spreading across the crown, and perhaps overhanging it, until at length some of the branches are suspended in graceful festoons. A tree thus invaded naturally is unable to expand and eventually dies ; but the climber itself does not stop its course. Having, perhaps, reached the ground, especially where the tree invaded is a small one, its growth is further stimulated by its lower branches rooting in the soil and forming new individuals. It also possesses the faculty of reproducing itself by root-suckers, so that when once it has entered a forest and if the leaf canopy has not completely formed, it spreads in all directions by this means and also by means of its stoloniferous branches.

In some instances after having reached the illuminated heights of a tree it is stimulated also to throw out another arm from its base, and this latter instead of attaching itself to the bole of the host and climbing up it, embraces one of its own scandent shoots that have grown old with the tree and been stripped of its foliage and coils tightly round it, restricting its circumferential growth at the parts in contact with the coils, forming strands like those of a cable. Such a scandent form is common in the canopied forests of the Bassein Range where the Ukshi, both as a climber and a shrub, may be seen to advantage.

In these interesting forests, which are at the base of the Tungar plateau in Bassein, the Ukshi stems here reach a girth of 1 to 2½ feet. Where the latter have grown old with the trees and where the older portions have been stripped of their foliage they resemble ropes loosely stretched between the ground and tree summits and between tree and tree, forming swings in some places and rope-ladders, as it were, for the monkeys.*

The branches of the Ukshi being annually lopped around villages between January and April for tahal as already explained it is not often seen in flower in such localities. The smaller twigs are utilized for native tooth brushes. The most interesting characteristic of the plant is its faculty of storing in its climbing stems, and especially those which have grown old with the trees, a liquid resembling water which is commonly drunk by the wild tribes to allay thirst when water is not available. Such liquid is found in the stems at almost all periods of the dry season, but in greater abundance during the hot weather. It is obtained only from the stems of the scandent shrub. To obtain it a piece of the stem five feet long is entirely removed from the stem and held up vertically, a vessel being placed beneath into which the water, as we may call it, dribbles as freely as from a tap. As much as a quart has been drawn from four pieces of the following dimensions in this manner :—

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* *Vide* Kerner's "Natural History of Plants."

Length.	Girth.
2′-8″	1′
2′-7″	10″
2′-3″	1′
2′-2″	10″

In order to procure the water it is necessary that the operation of removing the required piece from the bole should be quickly performed, *i.e.*, the sections above and below should be made as rapidly as possible; otherwise most of the water rises in the stem and fails to exude. If a section is made at one end only, or if an incision merely is made in the wood, little or no exudation of the water takes place. On being drawn it resembles clear spring water in appearance and is not at all unpleasant to drink. After exposure for a few hours, however, it turns a pale amber colour.

Through the courtesy of Mr. W. L. Harvey, I.C.S., C.I.E., Municipal Commissioner, Bombay, the following interesting report of the analysis of the sample of the water has been made by the Municipal analyst, and Mr. Harvey, in forwarding the report, adds—"The Health Officer is of opinion that it is not injurious to health if used for drinking purposes"—

Total solids	0·07	per cent.
Mineral matter	0·02	,,
Organic and volatile matter	0·05	,,
Total acids (in terms of c.c.N/10 alkali required).	6·8	,,
Volatile acids (do. do.)	5·1	,,
Fixed acids (do. do.)	1·7	,,

"The organic matter was found to consist of a tanin and traces of albuminoids and gummy matter, while alcohol, starchy and saccharine matter was tested for with negative results. The free acid in the sample consists of acetic and other acids. The mineral matter in the sample consists of chlorides, sulphates, lime, ferric oxide and sodium oxide together with traces of nitrates and potassium."

The water in a plant like *Calycopteris floribunda*, possessing such interesting economic value, is doubtless on occasions put to successful use by the wild tribes, especially the Kolis and Kathodis who of late years have been committing dacoities in the Thana District. Capturing the dacoits has always been a difficult task, but it was thought this task would be facilitated during the hot weather when most of the pools, &c., had dried up in the forests. The police accordingly, in expectation of apprehending their prey, have kept a watch over the different pools in the jungles, but without much, if any, result. May not the water provided by the Ukshi have been the charm which enabled the dacoits to keep the police at arm's length? Under the facilities provided by the plant for quenching thirst the dacoits would be able to be independent of all pools and springs, and could wander at will through the forests. This suggestion is thrown out to some of our experienced, not to say smart, police officers whose attention is invited to the interesting economic use to which it is possible to apply the Ukshi, presuming such use has not been heard of before.

The climber is found in some of the numerous cänon-like ravines which exists along the western projection of the ghâts, an area which for a long time has been the favourite haunts of the dacoits, and it is also a noticeable plant in the forests surrounding the well-known Tungar plateau as already stated. Its sylvicultural requirements are moderate amount of illumination and a humid and relatively cool atmosphere with a freely drained laterite soil, so that it flourishes best in the hilly forest along the Konkan Sea Coast and in the moist ravines more inland in the localities already alluded to.

Another climber known as Nandvel (*Vitis adnata,* Wall.) is exceedingly common in the forests almost all over Thana District, which also yields a harmless beverage which is utilized similarly to quench thirst when water is not available in forests, but it produces slight throat irritation after swallowing, which renders it less popular than the water from *Calycopteris.* It is often found where the latter does not exist however, and under such circumstances it is frequently resorted to instead for drinking purposes.*

Forest guards have told me that they have been under the necessity of resorting to the water from Nandvel when working in some out-of-the-way forests or on the summit of a hill slope when marking coupes, and it was in this way that my attention was first attracted to the interesting quality possessed by Nandvel and which ultimately led to my ascertaining the same uses in the Ukshi.

At page 7, Volume XXII, of the "Indian Forester" *Vitis latifolia*† is reported, I see, to yield also a beverage which the Dehra Dun students sometimes indulge in when in the forests. A few other trees, etc., in the Thana forests are found which yield liquids resembling water from either the roots or their stems and which are turned to various economic, medicinal and other uses, and a description of these it is proposed to leave for another occasion when an opportunity offers.

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* When marching through the forests along the Waitarna River in Mokhada with Mr. Clyton, I.C.S., it was observed how frequently the Nandvel had been cut.

† *Vitis latifolia* is also found in the Thana forests, and it probably also yields water similar to *Vitis adnata*. Both are known as Nandvel.

THE BIRDS OF THE MADHUBANI SUB-DIVISION OF THE DARBHANGA DISTRICT, TIRHUT, WITH NOTES ON SPECIES NOTICED ELSEWHERE IN THE DISTRICT.

By C. M. Inglis.

Part VIII.

(*Continued from page* 343 *of Vol. XV.*)

Addenda et Corrigenda.

(4) Parus atriceps.—The Indian Grey Tit.

I mentioned that this species arrived about the third week of September, but in 1901 I obtained one on the 17th July, near Baghownie.

(11) Otocompsa emeria.—The Bengal Red-whiskered Bulbul.

This species is a rare bird near Baghownie. I have only seen one or two specimens.

(327) Acrocephalus stentoreus.—The Indian Great Reed-Warbler.

Oates, No. 363 ; *Hume, No.* 515.

On the 19th November 1902 I obtained a female of this species near Baghownie.

(328) Chætornis locustelloides.—The Bristled Grass-Warbler.

Oates, No. 392 ; *Hume, No.* 441.

On the 17th June 1902 several specimens were procured in the Ramowlie grass which lies between Hatauri and Anarh.

(329) Phylloscopus tytleri.—Tytler's Willow-Warbler.

Oates, No. 406 ; *Hume, No.* 500 *bis.*

A Willow-Warbler was brought to me on the 8th October 1901 by a boy who shot it with a pellet bow. I take it to be this species.

(32) Tephrodornis pondicerianus.—The Common Wood-Shrike.

A nest containing three fresh eggs, along with one of the parent birds, was brought to me on the 12th March 1904. It was found in a mango grove near Baghownie.

(40) Oriolus kundoo.—The Indian Oriole.

In 1901 this species arrived at Baghownie on the 10th March, ten days earlier than the date I gave when writing about this species.

(45) Temenuchus pagodarum.—The Black-headed Myna.

I have taken the eggs of this species in June. I also got a single young one, fully fledged, from a hole in a kheir tree on the 18th of that month, so the eggs must have been laid some time in May. Towards the end of April a pair was seen making nesting arrangements, but up to date of writing, the 6th May, they have not laid.

(46) Acridotheres tristis.—The Common Myna.

A bird was seen a few miles from Baghownie, which had a pure white tail. The remainder was in ordinary plumage.

(49) Sturnopastor contra.—The Pied Myna.

A nearly pure albino of this species was brought me by a *mir-shikar* on the 30th August 1903. I append a description of the same.

Whole plumage pure white, with the following exceptions :—Remiges pure black, except the first or fifth primaries on one wing and the fifth on the other wing, the first on that wing being black. First secondary also white. One or two of the median coverts also black ; some black feathers near the nares and a few on the crown also—black patch on the side of the breast near the bend of the wing ; one or two greyish feathers on the breast and abdomen. Rump mixed black and white. Rectrices black except the outermost feather, which is white.

(53) CYORNIS RUBECULOIDES.—The Blue-throated Flycatcher.

A fine male was procured near Baghownie on the 26th November 1902.

(56) TERPSIPHONE PARADISI.—The Indian Paradise Flycatcher.

Adult males sometimes have the feathers of the tail next the central one lengthened, as has been noticed in the case of *S. affinis* by Mr. E. C. Stuart Baker.

(61) PRATINCOLA LEUCURA.—The White-tailed Bush Chat.

A pair of birds of this species was shot on the 21st March 1904 at Benoa where a small party were seen in a large grass.

(62) P. INSIGNIS.—Hodgson's Bush Chat.

Males of this species were obtained at Baghownie in October 1902.

(330) THAMNOBIA CAMBAIENSIS —The Brown-backed Indian Robin.

Oates, No. 661; *Hume, No.* 480.

In December 1900 one of my men fired at a bird, which, I think, must have belonged to this species, and as it had white on the coverts, it was a male.

(68) CITTOCINCLA MACRURA.—The Shama.

One was fired at and missed on the 28th August 1901. A female shot near Baghownie on the 9th October of the same year, and which was dissected by myself, was in male plumage with the mouth yellow.

(80) SPORÆGINTHUS AMANDAVA.—The Indian Red Munia.

From observations taken from specimens in captivity, males do moult into a winter plumage. This year I intend keeping notes on the subject.

(81) CARPODACUS ERYTHRINUS.—The Common Rose-finch.

A flock of about twenty were seen near Baghownie flying on the 14th March 1904 in some jungle, out of which three were shot.

(331) EMBERIZA FUCATA.—The Grey-headed Bunting.

Oates, No. 790 ; *Hume, No.* 719.

A male of this species was got near Baghownie on the 25th March 1904. The testes were greatly enlarged. Oates says he has never seen a specimen of this Bunting from the plains proper, but evidently Jerdon was correct when he said it was found sparingly there in places.

(332) MELOPHUS MELANICTERUS.—The Crested Bunting.

Oates, No. 803 ; *Hume, No.* 724.

A small party was found at the same place and on the same date as the Rose-finches. They kept to the trees and would not come to the ground. I wanted my *mir-shikar* to snare some, but he was unable to do so, so several specimens were shot.

(333) ANTHUS STRIOLATUS.—Blyth's Pipit.

Oates, No. 846 ; *Hume, No.* 601.

Several specimens were obtained near Baghownie, and a nest with four eggs was taken there on the 16th April 1904. They appear to keep more to the shade of trees, such as the kheir, *&c.*

(104) ALAUDA GULGULA.—The Indian Sky-lark.

A nest with two eggs was taken on the 28th April 1904 near Baghownie, and several others were found, but without eggs.

(334) PITTA BRACHYURA.—The Indian Pitta.

Oates, No. 933 ; *Hume, No.*

A single male of this species was got in a mango grove, near Baghownie, on the 13th May 1904. It had just alighted on the ground from one of the mango trees and was by itself. None of the native fowlers round here recognize the bird, so it must be very rare. This is the only one I have ever seen, and it is not a species that is likely to be overlooked. A female got on the 21st of the same month.

(130) HALCYON PILEATA.—The Black-capped Kingfisher.

Several more specimens have been procured since writing about this species. Though undoubtedly rare, it is not so scarce as I thought it was. Native name *Ablak tanki.* All white varieties or albinos of birds are called *Ablak* by the native fowlers here, so they evidently take it to be only a variety of *H. smyrnensis.*

(335) ANTHRACOCEROS ALBIROSTRIS.—The Indo-Burmese Hornbill.

Blanford, No. 1053 ; *Hume, No.* 142.

A hornbill came to a tree quite close to the bungalow. One of my servants saw it there, and said it had been there all the morning. I went to have a look at it, but could only see the breast and abdomen, which were pure white, as the bird was hidden by a clump of parasite (*Loranthus sp.*) My servant saw the bird, and said the head and the neck was a mixture of black and white, the upper breast was black and the abdomen white. The bill, he said, was yellowish. I did not disturb the bird, as I expected my man in with my gun at any moment and thought I might get a shot at it. It flew away, however, before he arrived. I showed the man who saw the bird a skin of *A. albirostris,* and he said it was like it, except the head and neck, which were banded with black and white. I cannot identify the bird unless it was this species.

(336) CACOMANTIS MERULINUS.—The Rufous-bellied Cuckoo.

Blanford, No. 1113 ; *Hume, No.* 209.

An adult male of this species was shot near Baghownie on the 7th November 1903.

(148) PALÆORNIS CYANOCEPHALUS.—The Western Blossom-headed Paroquet.

A nest with two eggs was taken from a hole in a sisso tree at Jainagar on the 20th March 1904. This is the first I have seen.

(150) STRIX CANDIDA.—The Grass-Owl.

I have seen several of this species in some small grasses near Hatauri, and some also frequent the large Ramowlie grass.

(154) Scops giu.—The Scops Owl.

Another specimen, a female, was got near Baghownie on the 20th November 1902.

(155) S. bakkamœna.—The Collared Scops Owl.

A nest containing four slightly incubated eggs was found in a hole in a peepul tree not far from Baghownie.

(157) Ninox scutulata.—The Brown Hawk-Owl.

One or two more specimens have been obtained near Baghownie since writing about this species.

(180) Accipiter nisus.—The Sparrow-Hawk.

I obtained a specimen at Baghownie on the 28th November 1902.

(337) Turtur orientalis.—The Rufous Turtle Dove.

Blanford, No. 1304 ; *Hume, No.* 793.

A solitary specimen was shot by me in my compound at Baghownie on the 27th August 1903. It was undoubtedly this species as I compared it with my Cachar specimens.

(193) Turtur ferrago.—The Indian Turtle Dove.

I have also taken the eggs of this species in July as well as during the months previously mentioned.

(199) Coturnix coromandelica.—The Rain Quail.

The first and only specimen of this species obtained by me was got on the 5th May 1904. It was a male and was near Baghownie along with some Grey and Button Quail.

(338) Francolinus gularis.—The Swamp Partridge.

Blanford, No. 1376 ; *Hume, No.* 823.

A pair were brought me on the 19th March 1904 by a *mir-shikar,* who says he snared them in a large grass in the E. of this subdivision. He also mentioned that he had got the eggs, but ate them. He has promised to get me more birds and, if possible, the eggs. Mr. Edgell wrote me that he had shot this species in the Monghyr District. My pair are kept in an aviary along with a male Black Partridge and a lot of other birds. They never appear to quarrel with any of the other species ; in fact, they used to be bullied by an Australian Crested Dove (*Ocyphaps lophotes*). They are rather quiet birds, only occasionally uttering a loud quâ, quâ, quâ, which ascends in tone. I have heard no other note. They are very shy, keeping hid most of the day. The hen is not as shy as the cock.

(217) Anthropoides virgo.—The Demoiselle Crane.

A flock came to the Kamla, near Jainagar, about the end of April, out of which one was secured.

(218) Sypheotis bengalensis.—The Bengal Florican.

I have at last succeeded in getting a specimen of a Florican. It was brought here on the 28th of August. It was snared somewhere in the District and was alive when brought, but I believe in a very emaciated condition, the sides of the head are buff and the greater portion of the back is mottled.

(339) VANELLUS VULGARIS.—The Lapwing.

Blanford, No. 1436 ; *Hume, No.* 851.

A single bird was snared at the Maiser chaur on the 8th August 1903, but was too much damaged for preservation. This is the only one that has ever been got here.

(340) CHETTUSIA GREGARIA.—The Sociable Lapwing.

Blanford, No. 1437 ; *Hume, No.* 852.

A few were got at the Maiser chaur on New Year's Day, 1903, and again a few more on the 1st February of the same year.

(236) NUMENIUS PHÆOPUS.—The Whimbrel.

A second specimen, a male, was got at the Maiser chaur on the 12th September 1903.

(245) PAVONCELLA PUGNAX.—The Ruff and Reeve.

On the 15th February 1904 a male Ruff was shot near Baghownie with a white head and neck, except one or two dark feathers on the crown. Mr. Finn wrote an article on this form, to which he gives the sub-specific name of *Pavoncella pugnax leucoprora*, in the Journal of the Asiatic Society of Bengal, Vol. LXXI, Part II, No. 1 of 1902.

(341) TRINGA SUBARQUATA.—The Curlew Stint.

Blanford, No. 1477 ; *Hume, No.* 882.

A single male specimen, changing from summer to winter plumage, was snared on the Maiser chaur and brought to me on the 8th August 1903.

(254) LARUS ICHTHYAËTUS.—The Great Black-headed Gull.

Another specimen of this fine gull was got on the Benoa chaur on the 3rd March 1904. It was a male, in breeding plumage.

(268) PHALACROCORAX CARBO.—The Large Cormorant.

A fine bird in breeding plumage was got on the Benoa chaur on the 21st March 1904.

(277) CICONIA NIGRA.—The Black Stork.

At last I have succeeded in obtaining a specimen of this stork. A fine male was snared on the Roopuspur chaur on the 9th January 1904. I append the dimensions and colours of the soft parts of this specimen. *Length* 42″ ; *wing* 21″ ; *tail* 9·5″ ; *tarsus* 8″ ; *bill at front* 7·6″ ; *bill at gape* 8″ ; *expanse* 75·8″. Bill, orbital skin and legs vermilion ; former tinged with brown except at tip and base and front of tarsus brownish ; *iris* light brown. The native name I gave was correct.

(281) LEPTOPTILUS JAVANICUS.—The Lesser Adjutant.

Another specimen, a male, was got near Baghownie on the 15th September 1903.

(287) HERODIAS INTERMEDIA.—The Smaller Egret.

Two males, in full breeding plumage, have been obtained since my note on this species. One was got at Fureckeer in the Monghyr District on the 22nd April 1903, and the other at the Hurrietta chaur in this district on the 25th May of the same year.

(300) Sarcidiornis melanonotus.—The Nukta.

A couple more specimens of this duck have been got, both females. One was secured on the Maiser chaur on the 8th January 1903, and the other on the Benoa chaur on the 12th March 1904.

(301) Rhodonessa caryophyllacea.—The Pink-headed Duck.

Another pink-headed Duck was brought on the 25th June of this year. It was snared on the Benoa chaur, where the first specimen came from. This one seems very healthy and is at present in my water aviary in the company of a pair of Mandarins (*Æx galericulata*), a wild Duck (*A. boscas*), two Spot-Bills (*A. pœcilorhyncha*), a Shoveller (*S. clypeata*), a blue-winged Teal (*Q. circia*), a pair of Nicobar Pigeons (*C. nicobarica*), and an Australian Crested Dove (*O. lophotes*). They all seem to get along together well enough.

(307) Anas boscas.—The Mallard.

I have received another specimen from this district. It is a male, and was brought to me by a native fowler. At present I have got it alive.

(308) A. pœcilorhyncha.—The Spotted-billed Duck.

I believe this species breeds near Muktapur Factory in this district. This cold season, 1903-04, has been one of the worst for migratory wild fowl. Nothing decent has been seen or brought me, with the exception of the above-mentioned Mallard. Two of these ducks were brought here at the same time and from the same place as the above-mentioned pink-headed duck. One of them is at present alive in my tealery, and the other died. A third one was brought on the 15th July from the same place; this one is also alive. There were, I believe, about half a dozen of these birds in the chaur, but with bird lime the *mir shikar* only managed to snare one.

THE BUTTERFLIES OF CEYLON,

By

MAJOR N. MANDERS, R.A.M.C., F.Z.S., F.E.S.

(*Read before the Bombay Natural History Society on 24th November* 1904.)

The Island of Ceylon has now been so thoroughly ransacked for butterflies that assuredly very few species remain to be discovered, probably not more than half a dozen at the outside. Some general conclusions regarding their origin and distribution may now be ventured on and an analysis of the various species may be of some interest.

Before doing so it may be as well to recall the chief geographical features and climate of the Island, as it is on these two factors that the variation of butterflies, to my mind, chiefly depend. Cape Comorin, at the extreme end of the Indian Peninsula, almost reaches the 6th degree North latitude and is opposite Puttalam in Ceylon, a small village not more than eighty miles north of Colombo. The effect of this position is that nearly two-thirds of the Island is sheltered, as it were, by the Indian Peninsula, and this causes a remarkable contrast in the sheltered and unsheltered portions of the Island. It will be noticed, further, that the Hill districts of Ceylon are confined to the south-west portion of the Island, so that the whole of the northern and eastern part is either sheltered by the mountains of India or those of Ceylon, and this causes a very marked difference of climate in different parts of the Island. The South-West monsoon passing up the East Coast of Africa is deflected off the Island of Socotra across the Arabian Sea and divides into two currents, one of which strikes the Western Ghauts and the other the south-west portion of Ceylon. That current which strikes the Indian Peninsula loses its moisture in the Western Ghauts and Anamallai and Travancore Hills and reaches Ceylon north of Puttalam as a comparatively dry wind, and certainly a distinctly dry wind by the time it reaches Trincomalee on the east of the Island.

On the other hand, the mountains of the south-west portion of Ceylon receive the full benefit of the South-West monsoon in the Hills and comes to the South-East portion of the Island as a dry wind in a similar manner as in the north.

It will be noticed, therefore, that in the greater part of the Island the South-West monsoon is a dry wind. On the other hand, the North-East monsoon travelling over the Bay of Bengal reaches the northern and eastern part of the Island loaded with moisture, and a tremendous downpour, almost continuous, is the result. The mountains also receive a very fair amount, and even Colombo on the western sea board is treated to heavy afternoon and evening thunderstorms.

The climate of the Island, speaking generally, runs thus: From the end of January to the end of May it is dry all over the Island and there is very little wind; at the end of May to the end of September the South-West monsoon brings heavy rain to the Ceylon Hills, but a dry wind to the rest of the Island; at the end of October the North-East monsoon brings heavy rain all over the Island, but more particularly to the northern and eastern parts.

The Hills begin to rise about thirty miles from the western coast and sink again into the low country at a very considerable distance from the eastern and northern sea boards. As it is, that portion of the country devoted to tea and cocoa cultivation, and therefore more inhabited by Europeans, and as it possesses, near by, the most important harbour of Colombo and being, withal, the most beautiful and consequently the most visited district in Ceylon, it has obtained a notoriety certainly most deserving, but at the same time of undue prominence, taking into consideration its small area compared with the rest of the Island.

There is no doubt that the usually received ideas regarding Ceylon are, if taken as a whole, erroneous, for of the large number of globe-trotters and others who visit Ceylon annually not one in a thousand visits the low country, but confine their peregrinations chiefly to Kandy and Nuwara Eliya in the Hill district.

The physical configuration of this portion of the Island and that of the Western Ghauts being so similar, and the climate also being almost identical, together with, in all probability, a land connection in far off times, probably accounts for the remarkable similarity of the butterflies found in these regions.

They form a very natural group which extends to the North Kanara district in India and thence gradually thins out and disappears a little to the north of Bombay. It also extends to the Nilgiris, which are an off-shoot of the Western Ghauts, but which have in addition some species such as *Colias Nilgiriensis* of palæarctic affinities. The similarity of the butterflies of the rest of the Island with those of the Deccan and plains of the Madras Presidency is likewise to be accounted for by like conditions of physical characteristics, climate and propinquity.

Two hundred and thirty species of butterflies have been recorded from Ceylon. Of these 163 are mostly common and widely distributed insects, such as *Pyrameis cardui* and require no further mention, as the Ceylon insects do not vary from those found elsewhere. The following three species are confined to Ceylon, but show affinity to Malayan or Chinese species :—

Danáis exprompta.
Euplœa corus=elisa.
Elymnias singhala.

Fifteen species are confined to Ceylon :—

1. Danais taprobana.
2. Lethe dynsate.
3. Lethe daretis.
4. Euthalia vasanta.
5. Lampides coruscans.
6. Lampides lacteata.
7. Cyaniris lanka.
8. Aphnæus greeni.
9. Aphnæus minima.
10. Hantana infernus.
11. Sarangesa albicilia.
12. Baracus vittatus.
13. Suastus minuta.
14. Halpe egena.
15. Halpe decorata.

The following 47 species form the Indo-Ceylon group, those in *italics* are found in South India and Ceylon and nowhere else; the others are confined to Ceylon and are probably local races of South Indian insects :—

1. Hestia jasonia.
2. *Danais ceylanica.*
3. Euplœa asela.
4. Euplœa sinhala.
5. Euplœa montana.
6. *Mycalesis rama.*
7. *Mycalesis subdita.*
8. Mycalesis patnia.
9. Elymnias fraterna.
10. *Discophora lepida.*
11. Charaxes psaphon.
12. Parthenos cyaneus.
13. Euthalia evelina.
14. Limenitis callidosa.
15. Neptis sinuata.
16. *Cupha placida.*
17. Rohana camiba.
18. Cethosia nietneri.
19. Cynthia asela.
20. Cirrhochroa lanka.
21. Kallima philarchus.
22. *Atella ceylonica.
23. *Ergolis taprobana.*
24. Libythea rama.
25. *Libythea lepitoides.*
26. Abisara prunosa.
27. *Cyaniris singalensis.*
28. *Arrhopala pirama.*
29. *Hypolycæna nilgirica.*
30. Horaga cingalensis.
31. *Loxura arcuata.*
32. *Cheritra jaffra.*
33. *Rapala lankana.*
34. *Rapala lazulina.*

35. *Prioneris sita.*
36. Ixias cingalensis.
37. *Teracolus tripuncta.*
38. *T. eucharis.*
39. *Appias taprobana.*
40. *Hebomoia australis.*
41. *Huphina remba.*
42. *Nepheronia ceylanica.*
43. Troides darius.
44. Papilio jophon.
45. Papilio mooreanus.
46. Iliades parinda.
47. Parata butleri.

With regard to those species which show relationship to Malayan or Chinese species, it appears to me possible that all may have been introduced indirectly by man's agency, for the following considerations, which if sound, show that the butterfly fauna of Ceylon has no real connection with the Malay peninsula or countries adjoining thereto.

Elymnias (Dyctis) Singhala is undoubtedy a local race of *E. lutescens,* a variable Malayan species, and was, until a few years ago, almost entirely confined to the Royal Botanic Gardens at Peradenia near Kandy, and even now is confined to the immediate neighbourhood. The larva feeds on various species of *Palmaceæ* and it appears to me possible, if not probable, that the Malayan species was introduced into the Island with some species of Palm from Singapore or its neighbourhood. If this should have been the case it gives us some guidance as to the length of time it has taken to produce a local race of *Elymnias.*

The Peradenia Gardens were started about the year 1820. *E. Singhala* was described in 1874, so we may say, that it has taken less than 46 years to produce this new distinct species.

The other species *Danais exprompta* and *Euplœa corus* have much in common; the distribution of both is identical, and both are capable of surviving very rough usage; they are entirely confined to the coast and twenty miles or so inland, that is to say, the foothills extending from Galle in the south to about ten miles beyond Colombo on the north. The food plant of *D. exprompta* is unknown, but that of *E. corus* is a common jungle tree.

D. exprompta is one of the numerous local races of *D. similis,* a Chinese species, which is called *D. vulgaris* in Burma, *D. persimilis* in Siam, and so on. *Euplœa corus* is probably most nearly allied to *E. castelnaui,* a Malayan species. Neither *D. exprompta* nor *E. corus* have any relation to the Indian species of the *Danainæ.* Galle was, until some thirty years ago, the first port in the Island, Colombo at that time being in a very inferior position, but, with the completion of the breakwater at Colombo, Galle very rapidly fell from its high estate and is now almost deserted. Taking into consideration the tenacity of life exhibited by the *Danainæ,* it does not appear to me altogether improbable that the progenitors of these two species were accidentally introduced into the Island at Galle, and have survived in a restricted area and have there developed local races.

I may mention that immediately to the south of Galle the dry portion of the Island commences and is of quite a different character to the country north of it. In the neighbourhood of Galle these two species are fairly abundant, but they become scarcer as one approaches Colombo, and possibly extended cultivation may have something to do with this. The larva of *E. corus* is not infrequently brought in by natives for sale, as it is very conspicuous and easily collected. It is remarkable what a large proportion suffer from the attacks of parasitic flies in spite of the warning colouration.

With regard to the fifteen species confined to Ceylon and hitherto recognised as distinct, it is quite possible that further knowledge of the South Indian butterflies will prove that even this small number will be still further reduced. *Euthalia vasanta* may be only a pronounced local race of *E. garuda* which is somewhat scarce in Ceylon, and the local race in this instance would appear to be gradually supplanting the parent form. *Aphnæus greeni* is known by a single specimen only and may not be distinct. It was captured by Mr. E. E. Green in an open space in jungle on the summit of the Great Western Range at an elevation of 5,000 feet, a locality very difficult of access and not visited by an entomologist either before or since Mr. Green's visit. *Aphnæus minima* was described by Butler from a Ceylon specimen, and the type is now in the South Kensington Museum. I have a similar specimen which I look at Trincomalee in company with a crowd of the common *A. vulcanus*, and I have no doubt that it is merely a sport or occasional aberration of that species though it looks fairly distinct.

Lampides coruscans and *L. lacteata* are also to my mind doubtfully distinct : they may be forms of *L. elpis.*

Danais taprobana is a very distinct and handsome species unlike any other of the genus known to me. It is entirely confined to the Hills and rarely descends below 4,000 feet. Above this it is abundant, particularly about Nuwara Eliya, 6,200 feet, and the Horton Plains, 7,000 feet.

Lethe daretis is also very distinct and is likewise confined to the higher elevations, rarely descending below 4,000 feet. Above this it is common in bamboo jungle nearly all the year round. The female flies low among the bushes and along jungle paths. The males are rarer, or at any rate are less frequently met with, and have the habit on sunny mornings of flying rapidly round tops of forest trees far out of reach like our *Apatura iris.*

Cyaniris lanka is another insect seldom met with below 4,000 feet. The males are abundant nearly all the year round, sucking up moisture from damp sand. The female is much less frequently seen, and usually occurs in the light jungle and often among the tea bushes.

The *Hesperiadœ* in the above list, with the exception of *Sarangesa albicilia* which is of general distribution, are confined to the Hill districts and adjoining low country. They are mostly rare, but probably only require looking for. *Halpe decorata* is particularly rare and has only been taken, so far as I know, in one locality, Avisawella, about twenty miles from Colombo, and this locality has, I believe, now been destroyed.

Lethe dynsate is in some respects the most interesting butterfly in Ceylon. Though described by Hewitson so long ago as 1863 it still remains one of the rarest of Ceylon butterflies. It is not confined to the Hill district, and though exceedingly rare and local has been found within twenty miles of Colombo on the coast as well as at Nuwara Eliya at an elevation of 6,200 feet. Structurally it is of special interest, as it is the sole representative of the Sub-genus *Hanipha moore,* characterised chiefly by the sex mark of the male being confined to the fore-wing, thus forming a connecting link between those species of *Lethe* which have a sex mark on both wings and those with none on either wing. The species may yet be found in Southern India, and I can give no reasonable explanation of its occurrence in Ceylon to the exclusion of other countries. Its nearest allies, *Lethe gulnihal, latiaris,* &c., occur in North-East India, Tenasserim and Malaya, but not, so far as I know, in Peninsular India.

The species of the Indo-Ceylon group as a whole show a distinct tendency to depth of colouring and marking when compared with the allied Indian species from the Himalayas or even Sikhim. The following genera will serve as examples :—

1. Danais.
2. Charaxes.
3. Parthenos.
4. Cethosia.
5. Cirrhochroa.
6. Ergolis.
7. Cyaniris.
8. Loxura.
9. Appias.
10. Nepheronia.
11. Troides.

Again, without exception, all the local races of Ceylon butterflies, though belonging to the above group, are darker in colouration than their allied Indian relatives ; as instances I may give—

1. Hestia jasonia.
2. Euplœa (in part).
3. Mycalesis patnia.
4. Elymnias fraterna.
5. Charaxes psaphon.
6. Limenitis calidosa.
7. Cethosia nietneri.
8. Cirhochoroa lanka.

To account for this is by no means easy, and I doubt whether an entirely satisfactory explanation is at present forthcoming. One point seems clear, and that is that all the species are influenced by some agent, having a continuous and universal action on them. Knowing as we do that changes of temperature, rainfall and the like have a marked influence on certain species, causing the so-called "wet" and "dry" season forms, it seems reasonable to assume that climate is a marked factor in causing this intensity of colouring in the Indo-Ceylon group, and if this is the case it seems to me a logical conclusion that climate has had a great deal more to do with the colouration of butterflies generally than some entomologists are ready to allow. So far as our knowledge goes at present it is impossible to say at any rate among tropical butterflies *exactly* how much heat or moisture is necessary to produce a "wet" or "dry" form, but undoubtedly there is a good deal of evidence to show that heat and moisture tend to produce certain colours and intensify, or reduce, the colouring of a species according to its geographical and climatal conditions.

Deep blue or purple in a tropical butterfly is almost invariably indicative of a habitat of deep jungle amidst sombre surroundings with a climate of heavy rainfall and a high temperature throughout the year, as for instance, *Thaumantis diores.* The deep blue of *Kallima limborgii* has doubtless been produced by the above conditions.

It may be assumed that the various species or local races of the orange-banded Himalayan and Burmese *Kallima* are derived primarily from one species which we knew as *K. inachus.* It extends over hundreds of miles of country from Tenasserim in the east to the Murree Hills in the west. The climate of this extensive area is naturally extremely diversified and the colouration of the butterfly ranges from an Oxford blue in the east to an almost Cambridge blue in the west. The former colour is produced by continuous heat and heavy continuous rainfall. In Sikhim and Nepal, the heat and rainfall are not continuous throughout the year, the late winter and spring months being dry and somewhat cold in the localities frequented by *Kallima*, though both heat and rainfall in the lower valleys are very great in the summer months ; such a climate produces typical *K. inachus.* In the Western Himalayas there is bright sunshine, and though the heat is considerable it is nothing like that of Sikhim, and both it and the rainfall are far less than further east. This climate produces *K. huegelii.* In the neighbourhood of Mussoorie in the Dehra-Dun both the dark and light-blue forms occur, from which I infer that the climate is not sufficiently pronounced either way to produce a permanent form, but permits both to flourish. A somewhat similar pale form of *K. limborgii* occurs, together with the type in the Shan States where the climate is more temperate and the rainfall less than in Tenasserim where *limborgii* only is found. The climate of the Indo-Ceylon region is in many respects similar to Lower Burma, there being rain during the greater portion of the year and continuous tropical heat, which two factors together have probably caused that intensity of colouring which distinguishes the butterflies of this tract of country. Similar causes have in all probability produced the still greater amount of colouring which distinguishes the local races of Ceylon butterflies from their neighbours across the Gulf of Manaar. But to ascertain with any hope of success the exact amount of extra rain and heat* necessary to develop these forms seems at present hopeless.

Some assistance may be derived from the study of the seasonal changes to which many Ceylon butterflies are subject. In some parts of the world, as in South Africa or the plains of Panjab, the same climate exists for several weeks or months over several thousand square miles of country, and an insect captured in Peshawar in June would not necessarily vary from one captured in Mooltan in the same month. In Ceylon it is quite different ; though I have given above the characteristics of the climate generally it is to be remembered that it is an insular one, and secondary variations are considerable and dependent on very many topical causes. For instance, the rainfall at Colombo is about 75″, 120″ being the heaviest ever recorded ; whereas at Labugama, only 26 miles off, the rainfall, due no doubt to proximity to the Hills, is no less than 150″ or over ; and many other instances throughout the country could be adduced. A comparison of the butterflies from the above two localities would not be likely to show any differences, as the places being so approximate the intermixture of individuals would be too great.

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* If the local race of *Elymnias lutescens* has been produced in less than 50 years, the time required might not be so great as is generally presumed.

A comparison of the rainfall of the Ceylon Hill district and that of Travancore is exceedingly difficult to make with any degree of accuracy, and I have insufficient data to work on.

*Mr. H. S. Ferguson has given in his paper on the Birds of Travancore certain meteorological data, which I have compared with Ceylon statistics. It appears that the rainfall in the Ashambu Hills, which extend from Cape Comorin to 40 miles north with an average altitude of 4,100 feet, have an average rainfall of from 80 to 100 inches ; whereas in Ceylon the average rainfall at a similar altitude is 100 inches and over, and at an approximate altitude of 1,500 feet an average of over 200 inches.

So far as I can gather from statistics available, it seems clear that the average rainfall in Ceylon is distinctly higher than in corresponding districts in Travancore. I have no means of ascertaining whether there is any marked difference in the temperature, but I should say Ceylon undoubtedly is the warmer. It lies further south, and being insular the climate is more equable ; the extensive forest area of Travancore would cause increased evaporation with a lowering of the temperature after heavy rain. I may add that the rainfall of Trevandrum, 50 miles from Cape Comorin, is 65 inches, and that of Colombo, about the same distance south of the Cape, over 75 inches.

The above considerations, though by no means conclusive, tend to the hypothesis that the heavier rainfall and intenser heat of Ceylon have been the most important agents in producing the depth of colouring which distinguishes the local races of Ceylon butterflies. This naturally

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The Birds of Travancore, by H. S. Ferguson, Jnl., Bom. Nat. His. Soc Vol. 15, page 249 leads up to the question of so-called " wet " and " dry " seasonal forms and the causes thereof.

There is no doubt that with the curious exception of certain species of *Pierinæ* the " wet " season form is invariably darker than the " dry." Specimens of many species which do not produce marked seasonal forms if caught in the rains show a depth of colouring which is absent in " dry " weather (*i.e.*, *Cynthia*).

DESCRIPTIONS OF SIXTY-EIGHT NEW SHELLS FROM THE PERSIAN GULF, GULF OF OMAN, AND NORTH ARABIAN SEA, DREDGED BY MR. F. W. TOWNSEND, OF THE INDO-EUROPEAN TELEGRAPH SERVICE, 1901—1903.

By James Cosmo Melvill, m.a., f.l.s., f.z.s., and Robert Standen,
Assistant Keeper, Manchester Museum.

Part I. Plates A, B.

(*Reproduced from the Annals and Magazine of Natural History Ser. 7, Vol. XII.*)

Two years ago we published a Catalogue * of the Mollusca of the Persian Gulf, &c. (Cephalopoda, Gastropoda, and Scaphopoda only), mainly collected by Mr. Townsend in 1893—1900, and enumerating 935 species. In the interim further large consignments have been frequently forwarded by the same energetic collector from many different stations and depths, including especially the results of one particularly profitable dredging on 7th April, 1903, in the Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., at 156 fathoms, which, it is no exaggeration to say, positively teems with novelties. All this has naturally delayed publication of the second portion—to contain the Pelecypoda—of the abovementioned Catalogue.

At the present opportunity we offer descriptions of many Gastropoda, mostly of small size, though a few—e. g., *Murex*, *Marjoriæ*, *Trichotropis pulcherrima*, and the highly sculptured and unique *Pleurotoma navarchus*—are more conspicuous. The *Scalæ*† are enumerated elsewhere.

Amongst the "minutiora" we would call especial attention to the two new species referred to *Homolaxis*, the *H. cornu-Ammonis*, especially, being entirely evolute from the apical whorl and exactly like a microscopic "ram's-horn." *Cyclostrema euchilopteron*, *prominulum*, and *Emarginula undulata* are very wonderful in their sculpture. A *Fluxina*, the first recorded from the Old World, and the curious *Rissoina registomoides* are both noteworthy. So is a new species of *Metula* (*M. daphnelloides*) and many Pleurotomidæ, this family ever having the pre-eminence in abyssal waters. The *Kleinella sympiesta*, also near akin to *K. cancellaris* and *sulcata* of Adams, belongs to a genus which has not before been known to exist in the Arabian Sea or Persian Gulf.

To Mr. Edgar Smith, I.S.O., and Mr. E. R. Sykes we must express our best thanks for assistance, likewise to Mr. G. B. Sowerby, and Mr. W. Neville Sturt, of the India Office.

EMARGINULA UNDULATA, sp. n. (Pl. A. fig. 1.)

E. testa parva, delicata, albida, oblonga, apice multum recurvo, marginem posticum fere superimpendente ; radiis costalibus ad 40, majoribus cum minoribus sæpius alternantibus, posticis crassis, firmis, cæteris delicatis, undulato-crenatis, undique transversim elegantissime et arcte concentrice liratis,

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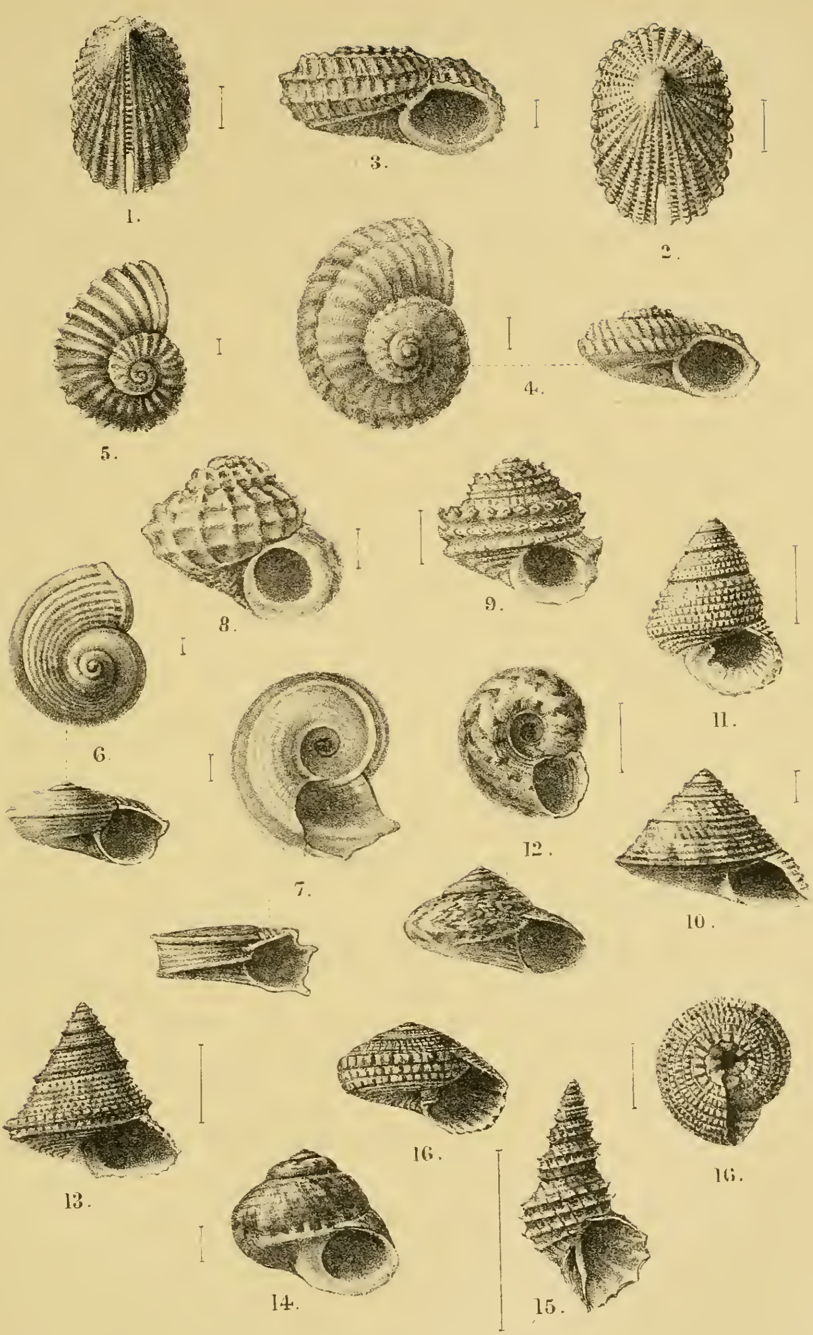
* Proc. Zool. Soc. 1901, vol. ii, pp. 327—460.

† Journ. of Conch. x., pp. 340 *sqq.*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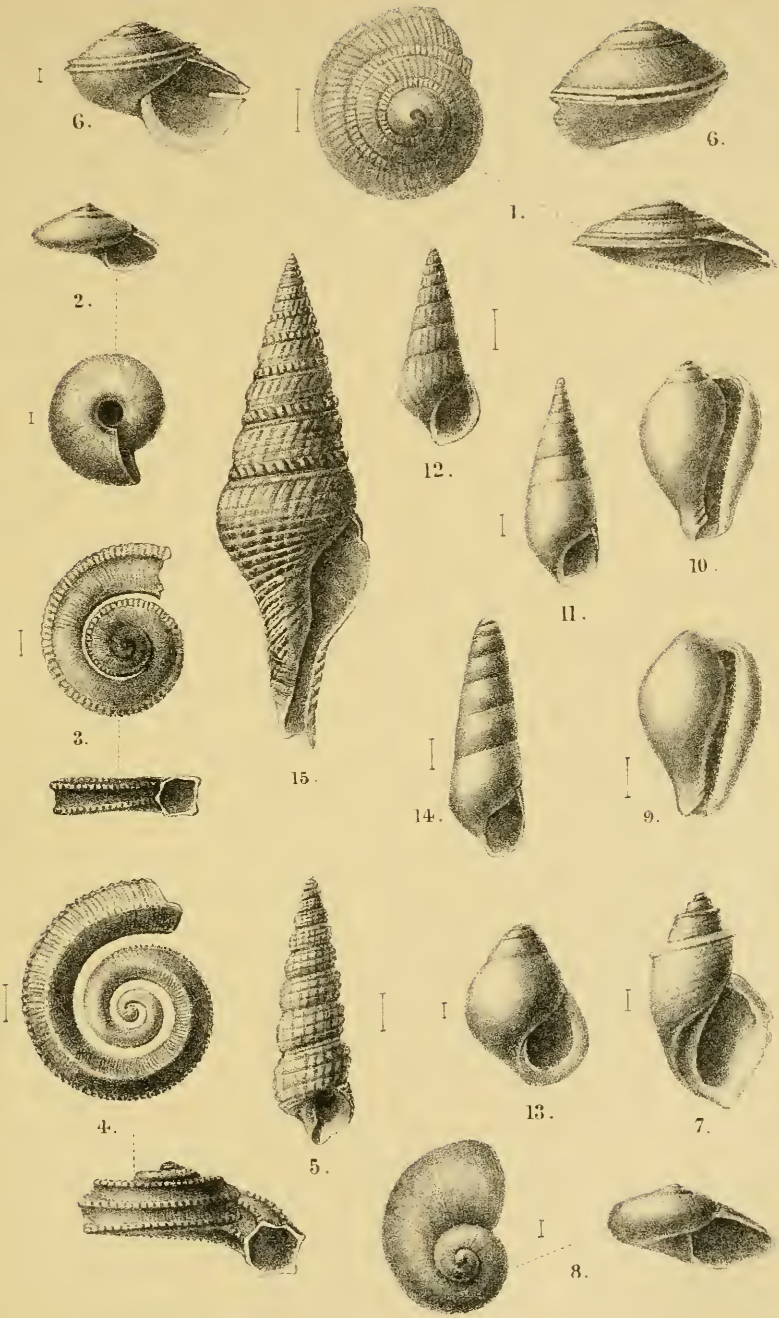
J. Green del. et lith
Mintern Bros imp.

NEW SHELLS from the Persian Gulf,
Gulf of Oman, and North Arabian Sea, dredged by
Mr. F. W. Townsend, of the Indo-European
Telegraph Service, 1901-3.

Plate B.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J. Green del et lith.

Mintern Bros imp

NEW SHELLS from the Persian Gulf, Gulf of Oman, and North Arabian Sea, dredged by Mr. F. W. Townsend, of the Indo-European Telegraph Service, 1901-3.

liris undulatis, continuis ; fissura angusta (in longitudine 2½ mm.) ; cicatrice fissuralivel septo conspicuo, circa 30-loculato, loculis crasse foraminatis, apertura oblonga, intus alba, margine crenulato.

Long. 5·50, alt. 2·50, lat. 3·75 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A particularly delicate species, with wavy crenulate rays, crossed by very characteristic, concentric, close-meshed liræ, continuously covering the rays and whole surface.

EMARGINULA CAMILLA, sp. n. (Pl. A. fig. 2.)

E. testa ovato-oblonga, depresso-conica, delicata, alba, apice supra medium recurvo, superficie omnino pulchre radiata vel costulata ; costulis ad 45, lævibus, nitidis, gemmato-nodulosis, majoribus cum minoribus sæpe alternantibus, liris undique spiraliter conjunctis ; interstitiis quadratulis, profunde foraminatis ; fissura antica angusta (in longitudine ad 2 mm.), septo inconspicuo ; apertura ovato-oblonga, intus alba, margine multicrenato.

Long. 6·50, lat. 4·50, alt. 3 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Of the same character superficially as *E. candida*, Ad., from Japan, *elongata*, Costa, &c., but differing from all in greater delicacy and fineness of sculpture.

CYCLOSTREMA HENJAMENSE, sp. n. (Pl. A. fig. 3.)

C. testa parva, depresso-discoidali, delicata, albida, profunde sed anguste umbilicata ; anfractibus 5, quorum duo apicales læves, mamillati, vitrei, cæteris apud suturas paullum excavatis, ultimo spiraliter septem-carinali, carinis duabus ad peripheriam quam maxime conspicuis, undique longitudinaliter arctissime et oblique costulatis, costulis supra coronulatis et gemmatis, regione umbilicari circa marginem carinata, deinde costulis longitudinalibus perspective delabentibus ; apertura subrotunda, intus alba ; peristomate crassiusculo continuo.

Alt. 3, diam. 6 mm.

Hab. Persian Gulf, Henjam Island, 10 fathoms, amongst coarse sand and broken shells.

A little species, which appears on the borderland between *Cyclostrema* and *Liotia*, the mouth-characters being Cyclostremoid. It is a particularly attractive species, the seven keels on the last whorl being closely longitudinally intersected by oblique riblets, these being gemmulate at the points of junction.

CYCLOSTREMA SUPREMUM, sp. n. (Pl. A. fig. 4.)

C. testa minuta, planato-discoidali, alba, nitidula, profunde umbilicata ; anfractibus 5, apud suturas excavatis, quorum duo apicales multum canaliculati, lævissimi, vitrei, cæteris depressiusculis, penultimo uni ultimo tricarinato, undique arctissime oblique costulato ; costulis lævibus, interstitiis spiraliter tenuistriatis, costularum numero ultimum apud anfractum circa 28, infra

peripheriam et circa regionem umbilicarem læviore, costulis ad basim fere evanidis; apertura oblique ovali, intus alba, labro paullum incrassato.

Alt. 1·50, diam. 4 mm.

Hab. Persian Gulf, near Fao. Likewise off Bunder Abbas, 5 fathoms, mud bottom.

A most exquisite species, beautifully cancellate and sculptured, though more or less smooth below the periphery and around the narrow but deep umbilicus. The whorls are all channelled at the sutures, this with a lens being very distinct at the apex.

The nearest ally is, perhaps, *C. eburneum*, Nevill (Journ. As. Soc. Bengal, xliv. part 2, p. 101, pl. viii. figs. 21,22), which is, however, a larger shell, with coarser sculpture proportionately.

CYCLOSTREMA ANNELLARIUM[*], sp. n. (Pl. A. fig. 5.)

C. testa parva, discoidali, profunde umbilicata, supra plana, alba, solidula; anfractibus tribus, quorum ultimus magnopere aliis exsuperans, rotundatus, undique costis longitudinalibus circularibus, numero ad quinque et viginti, præditus, interstitiis pulchre striatis; apertura rotundata, labro continuo, crassiusculo.

Alt. 1, diam. 2mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Exceedingly small, but well marked, being deeply umbilicate, flattened above, three-whorled, the last whorl large, provided with about twenty-four rounded longitudinal ribs. We know no species exactly comparable, *C. conicum*, Boog Watson, being, perhaps, the nearest, from Pernambuco ('Challenger' Expedition); but this, as its name implies, is conical in form. The interstices between the ribs are, as in *C. conicum*, beautifully spirally striate.

CYCLOSTREMA PROMINULUM, sp. n. (Pl. A. fig. 6.)

C. testa depresso-discoidali, delicata, alba, minutissima, profunde umbilicata; anfractibus quatuor, quorum duo apicales perlæves, subvitrei, cæteris duobus spiraliter undique multiliratis; liris lævibus, simul ac interstitiis, ultimo permagno, ad peripheriam acuticarinato; carina prominente, deinde ad basim lateribus obliquis, basi tumidula; apertura rotunda, labro tenui.

Alt. 1, diam. 2 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A very minute species, deeply umbilicate, white, with the surface uniformly multilirate, the lira at the periphery being metamorphosed into a strong, very prominent, and acute keel.

CYCLOSTREMA EUCHILOPTERON [†], sp. n. (Pl. A. fig. 7.)

C. testa parva, profunde umbilicata, albo-lactea, subpellucida, tenui, nitidiuscula, discoidali; anfractibus quatuor, apicali vitreo, lævi, omnibus, præter

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[*] *Annellus*, a small ring.

[†] εὖ, χείλος, πτέρον, from the winged process in connexion with the lip.

ultimum, depressis, undique concentrice tenuiliratis, ultimo recto, tribus carinis acutissimis prædito, prominulis, quorum superiore carina extra labrum projecta porrectionem trialatam præbente; apertura rotunda, labro extus tricarinato, intus simplici.

Alt. 2, diam. 3·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A wonderful little form, which seems from the description to come nearest to *C. Verreauxii*, Fisch., from California. It is a discoidally depressed, deeply umbilicate species, the last whorl furnished with three very prominently ridged keels, acutely projecting, and terminating in a triangularly winged extension of the upper part of the outer lip. Several examples, but by no means so abundant as *C. quadricarinatum*, M. & S., which was in thousands at the above locality.

*LIOTIA ROMALEA**, sp. n. (Pl. A. fig. 8.)

L. testa ovato-rotunda, parva, solida, anguste umbilicata; anfractibus 5, ad suturas excavatis, quorum duo apicales læves, margaritacei, cæteris, antepenultimo uni-, penultimo bi-, ultimo tricarinato, undique longitudinaliter arcte costatis, costis crassis, interstitiis striis longitudinalibus arcte præditis, basim versus, circa umbilicum, costis magnopere tumescentibus, spatio interstitiali spiraliter profunde fenestrato; umbilico profundo, perspectivo; apertura rotunda, intus albescente; peristomate albo, multum incrassato, obscure quinquangulari, continuo.

Alt. 5, diam. 5 mm.

Hab. Persian Gulf, Sheikh Shuaib Island, 10 fathoms; Maskat, 10-15 fathoms; also Gulf of Oman, lat. 23° 30′ N., long. 57° 10′ E., at 10 fathoms.

Several examples of a typical *Liotia*, coarser and smaller than *L. echinacantha*, but beautifully sculptured and with conspicuously thickened peristome, which is seen with the aid of a lens to be very obscurely five-angled.

LIOTIA ECHINACANTHA, sp. n. (Pl. A. fig. 9.)

L. testa globosa, anguste sed profunde umbilicata, pallide straminea, robusta anfractibus quatuor, quorum apicalis depressus, planatus, cæteris pulcherrime et arctissime sculpturatis, antepenultimo duobus, penultimo tribus, ultimo sex squamarum ordinibus prædito, squamis echinatis, spinarum instar, cavis, anfractu ultimo (et penultimo) ordine superiore, squamis incurvis, magis conspicuis, arctissime accincto, infra peripheriam, circa umbilicum, tribus ordinibus multe minoribus; apertura rotunda, intus margaritacea; peristomate crassiusculo, umbilico corneo, multispirali.

Alt. 6, diam. 7·50.

Hab. Persian Gulf, Gulf of Oman, Maskat, 10-15 fathoms.

A very beautiful little shell, not very near any of the genus with which we are acquainted. The scaly spines are characteristic, being fluted, hollow, and

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* ῥωμάλεος, robust.

profusely covering the surface, thrice-ranked on the penultimate, six-ranked on the last whorl; but three, however, of them are conspicuous, more particularly the one in both whorls just below the sutures. Around the umbilicus the three rows are not so highly developed. The operculum is horny and multispiral.

ENIDA PERSICA, sp. n. (Pl. A. fig. 10.)

E. testa parva, depresso-conica, solidula, profunde sed anguste umbilicata, albo-straminea, hic illic, præcipue apud peripheriam, spiraliter pallide rubro vel brunneo maculata; anfractibus 6, apud suturas gradatulis, quorum duo apicales vitrei, canaliculati, læves, cæteris, præcipue ultimo, spiraliter liratis, simul ac infra, juxta suturas, forti carina præditis (ultimo anfractu apud peripheriam bicarinato), longitudinaliter obliquissime sed obscure costulatis, costulis apud ultimum sæpius fere evanidis, ad juncturas lirarum præcipue supra, gemmulatis, infra peripheriam usque ad umbilicum spiraliter pulcherrime tenuiliratis; lira majore interdum cum minore alternante, undique minute gemmulatis; apertura subquadrata, labro paullum incrassato, regione umbilicari excavata.

Alt. 3, diam. 5 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Allied to the type of the genus *E. japonica*, Ad., but differing in both size and form. It is not so large or handsome as the recently described *E. Townsendi*, Sowb., from a neighbouring locality. The sculpture is elaborate for so small a shell; the liræ and carinæ on the last whorl number together six above the periphery, while below it there are ten, all being more or less granulate; the base is flattened, umbilical region somewhat excavate, mouth squarrose; the painting is pale red blotching, of a trigonal shape round the last two whorls, and most conspicuous at the periphery. Many examples occurred at the very prolific dredging-station mentioned above.

EUCHELUS TOWNSENDIANUS, sp. n. (Pl. A. fig. 11.)

E. testa oblongo-conica, staminea, solidula; anfractibus 7, quorum tres pallide straminei, apicales minute crenulati, subhyalini, cæteris spiraliter fortiter costatis; anfractu penultimo, simul ac antepenultimo, costis quatuor, ultimo novem (quorum quinque supra, usque ad peripheriam) undique gemmulatis, interstitiis favulosis, quadratis; apertura ovato-rotunda, labro regulariter brunneo-zonulato, intus multiplicato, margine columellari sinuoso-crenulato.

Alt. 11, diam. 6·50 mm.

Hab. Persian Gulf; Gulf of Oman, Maskat, 15 fathoms; also at lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

An *Euchelus* of somewhat familiar aspect, but not precisely comparable with any species either in our National Collection or mentioned in existing monographs.

SOLARIELLA ZACALLES[*], sp. n. (Pl. A. fig. 12.)

S. testa depresso-conica, profunde et late umbilicata, pernitida, lævi, solida, læte, rufo-brunnea, flammis fulgetrinis maculisque spiralibus hic illic depicta ; anfractibus 6, quorum apicales 1½ crystallini, læves, cæteris ventricosulis, supra, juxta suturas, regulariter spiraliter gemmatis, dein concentrice tenuiliratis, interstitis perlævibus, ultimo infra peripheriam nitido lævissimo, intus umbilicum pulchre multilirato, liris arcte gemmato-crenulatis, circa umbilicum ipsum radiatim breviter multisulculoso ; apertura obliqua, subrotunda, intus margaritacea, labro tenui, columella simplici, nequaquam reflexa.

Alt. 4, diam. 9 mm.

Hab. Persian Gulf ; Gulf of Oman, Maskat, 10—45 fathoms ; also in lat. 24° 55′ N., long. 57° 59′ E., 37 fathoms, sand and mud, and lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

We at first considered this species (and so inserted it in our Catalogue [†]) as identical with *Minolia gilvosplendens*, Melv., from the Philippines [‡] ; but, though extremely similar, there exist some very salient points of distinction. The latter is far more conical and the body-whorl obscurely bicarinate at the periphery, the umbilical sculpture in both being identical, this sculpture being, in fact, the chief point of difference between the species under discussion and *Solariella radiata*, Phil., from the Agulhas Bank, which is perfectly smooth and simple as regards its umbilical region.

The species of *Solariella* and *Minolia* are in great confusion, and monographs of these two genera are much wanted. The Rev. Dr. Gwatkin is devoting much time to the anatomy of the various forms, and finds many vital differences in the radula of some whose shells are nearly allied. We trust he may be induced some day to publish the results of his researches.

CALLIOSTOMA THRINCOMA,[§] sp. n. (Pl. fig. A. 13.)

C. testa conico-pyramidali, imperforata, solida, sculpturata, pallide straminea, spiraliter fusco-maculata, vel unicolore ; anfractibus octo, apicali vitreo, globulari, cæteris stramineis, ad suturas impressis, tegulatis, spiraliter undique pulcherrime granoso-liratis, supra, juxta suturas, carina prominula decoratis, ultimo anfractu ad peripheriam bicarinato ; apertura quadrata, margine columellari triangulatim incrassato.

Alt. 11, diam. 9 mm.

Hab. Persian Gulf ; Gulf of Oman, near Masket, lat. 23° 30′ N., long. 57° 50′ E., 88 fathoms.

Near *C. similare*, Reeve. A highly chased and sculptured species, though of small dimensions, and conspicuously keeled around every whorl just above the suture, the last whorl at the periphery being bicarinate.

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[*] ζακαλλης, extremely beautiful.

[†] Proc. Zool. Soc. 1901, vol. ii., p. 349.

[‡] Journ. of Conch. vi., p. 407, pl. ii., fig. 8 (1891). θρίγκωμα, a battlement.

LEPTOTHYRA RUBENS, sp. n. (Pl. A. fig. 14.)

L. testa globosa, parva, imperforata, solida, nitidula, infra lævissima, pallide, straminea, flammis castaneis decorata; anfractibus 4-5, quorum 1½ apicales apice ipso vitreo-albo, mamillato, cæteris gradatulis (ultimo rotundiore), undique infra medium lævibus, nitidis, supra arcte spiraliter sulculosis, ultimo ad peripheriam pallide spiraliter zonato, infra ad basim pulchre rubente; apertura rotunda, labro vix incrassato, nisi marginem apud columellarem albo-callosum, nitidum.

Alt. 4, diam. 4·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long 56° 54′ E., 156 fathoms.

A highly coloured little shell, which occurred somewhat plentifully at the above locality. The many specimens we have seen agree in sculpture and coloration almost uniformly. Near *L. læta*, Montr.

TRICHOTROPIS PULCHERRIMA, sp. n. (Pl. A. fig. 15.)

T. testa tenui, supra pergracili, attenuato-fusiformi, alba vel straminea, ochracea epidermide contecta; anfractibus octo, quorum duo apicales hyalini læves, cæteris multum apud suturas impressis, spiraliter acute bicarinatis, ultimo quadricarinato, epidermide quasi-costulas longitudinales setulosas arcte præbente; apertura late ovata, in typico specimine aurantia, in minore alba, labro effuso, tenui, columella fere recta.

Alt. 24, diam. 12 mm. (sp. maj.).

Hab. Gulf of Oman, on telegraph-cable, lat. 27° 12′ N., long. 51° 50′ E., 25 fathoms.

We have already* described another species of this usually Arctic genus from the Gulf of Oman, viz. *T. Townsendi*—a much smaller form. The present is far handsomer, being conspicuous for its graceful, rapidly attenuate whorls, much impressed suturally, the upper whorls twice, the lowest four times carinate. Two examples so far only obtained, the perfect larger example orange-mouthed, the smaller white. A third species, as yet undescribed, has lately been found to occur in small quantity in the dredging at 156 fathoms in the Gulf of Oman.

SOLARIUM (TORINIA) CERDALEUM†, sp. n. (Pl. A. fig. 16.)

S. testa anguste umbilicata, solida, pulchre sculpturata, depresso-conica, fusco-straminea; anfractibus 5, quorum 1½ apicales pallide rufi, nitidissimi, hyalini, cæteris quatuor ordinibus gemmarum spiralium, interstitiis minute unistriatis, præditis, quorum inferi regulariter hic illic brunneo-maculatis, in penultimo et ultimo anfractu ordine summo, juxta suturas, magno, gemmulato, ultimo ad peripheriam tribus carinis conspicuis brunneo-maculatis, simul ac infra, apud basim, septem ordinibus spiralibus decorato, duo circa umbilicum gemmulas

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* Proc. Zool. Soc. 1901, vol. ii. p. 360.

† κερδάλεος, advantageous.

maximas crenelliferas præbentes, interstitiis spiraliter unistriatis; apertura obscure quadrata, intus subochracea, nigro-brunneo zonata, labro angulato, tenui, marginem ad columellarem nitido, albo, incrassato, spiraliter tornato.

Alt. 5, diam. 8·50 mm.

Hab. Persian Gulf, Fao, on telegraph-cable, November 1902.

Of the same alliance as *S. dorsuosum*, Hinds, *cylindraceum*, Mighels, &c., but differing in the several characters as above given.

SOLARIUM ABYSSORUM, sp. n. (Pl. B. fig. 1.)

S. testa parva perdepressa, acutissime carinata, profunde umbilicata, tenui, albescente; anfractibus quatuor, quorum apicales 1½ tumidi, perlæves, hyalini cæteris apud suturas anguste canaliculatis, supra, juxta suturas simul ac infra, spiraliter liratis, interstitiis utrinqu arcte gemmulatis, deinde superficie media nitida, irregulariter longitudinaliter oblique striata, ultimo anfractu circa peripheriam acuticarinato, carina utrinque plano-marginata, infra, basim versus, spiraliter unilirato, dein superficie intermedia longitudinaliter rudicrenata, circa umbilicum ipsum duobus gemmularum ordinibus instructa, umbilico pulchre scalari; apertura trigonali, labro tenui, umbilicum nequaquam obtegente.

Alt. 3, diam. 6 mm. (spec. maj.).

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A great many examples, but no live specimens occurred, and but few in perfect condition. Allied to *S. oxytropis*, A. Ad., in form, but not in sculpture.

FLUXINA DALLIANA, sp. n. (Pl. B. fig. 2.)

F. testa perminuta, albo-hyalina, immaculata, depresso-discoidali, umbilicata; anfractibus 4, quorum apicalis globosus, mamillatus, submimersus, cæteris ad suturas canaliculatis, ventricosulis, lævissimis, ultimo ad peripheriam acuticarinato, carina marginata, sub lente elegantissime et minutissime crenellifera, basi convexiuscula, circa regionem umbilicarem paullum excavata, umbilico angusto, set profundo, scalari, margine acuto, simplici; apertura subquadrata, columella recta, supra umbilicum triangulatim reflexa.

Alt. 75, diam. 1·50 mm. (sp. min.).
„ 1, „ 2 „ (sp. maj.).

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., at 156 fathoms.

One of the most minute of recent shells; it agrees, however, in many particulars with *Fluxina discula*, Dall*, dredged in the 'Blake' Expedition off Dominica, W. I., at 982 fathoms. This, however, is nearly five times as large as our species, which was very rare in the above station.

We venture to dedicate this very interesting addition to the Oriental fauna to Dr. W. H. Dall, of Washington, who has done perhaps more than any other author to elucidate the benthal Molluscan fauna, and is the founder of the genus *Fluxina*.

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* Bull. Mus. Comp. Zool. Harvard College, vol. xviii. p. 273 (1889).

HOMALAXIS CORNU-AMMONIS, sp. n. (Pl. B. fig. 4.)

H. testa minuta, alba, omnino evoluta, delicata, depressulo-discoidali ; anfractibus quatuor, quorum duo apicales connexi, vitrei, globosi, duobus ultimis hexagonis, utrinque tri-carinatis, squamosis, carinis sex minute et formosissime echinulatis, undique longitudinaliter tenuiliratis, liris arctis, inconspicuis ; aperture sex-angulata, intus alba, labro tenui.

Alt. 2, diam. 5 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A very extraordinary, though minute, species, the chief peculiarities consisting in the completely evolute hexagonal whorls, the keels being most beautifully echinulate, the spaces also between the carinæ are longitudinally lirate. In form it is discoidally depressed, with two glassy globular apical whorls. We cannot exactly follow the reasons which prompt Dr. Fischer (Man. de Conch. p. 714) to propose a subgenus *Pseudomalaxis* for *H. zanclea*, Phil., and consider all the true *Homalaxis*, Desh., tertiary fossils. In our opinion both the species now described belong to the typical genus, and it would be impossible to disassociate *H. pernambucensis* (Wats.), described as a *Bifrontia*, from them. In the latter the last whorl is partly evolute.

The Rev. R. Boog Watson (Report 'Challenger' Exped. xv. p. 137) would allow the barbarous term *Omalaxis*, Desh., 1832* (afterwards altered to *Homalaxis*), to lapse, it being derived from two languages, and institute *Bifrontia*, also of Deshayes, 1833. But we fear that very many terms used in Zoology, and accepted, are likewise of hybrid origin, and *Homalaxis* must therefore stand, in spite of its disadvantageous origin.

HOMALAXIS ROTULA-CATHARINEA sp. n. (Pl. B. fig. 3.)

H. testa minuta, depresso-discoidali, alba, delicata, semievoluta ; anfractibus quatuor, rectis, utrinque bicarinatis, apicali immerso, simplici, antepenultimo lævi, parum nitente, penultimo, simul ac ultimo, pulcherrime sculpturatis, evolutis, utrinque bicarinatis, carinis—præcipue externis—apud margines minute echinato-crenulatis ; apertura quadrata, labro tenui, margine columellari paullulum reflexo.

Alt. 1, diam. 3 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long 56° 54′ E., 156 fathoms.

A most exquisite shell, in many points resembling *H. zanclea,* Phil., but more delicate in every detail. *H. disjuncta,* Lam., a tertiary fossil from Grignon, is very much larger indeed, but comes in the same category as our species, which occurred frequently at the above locality. It bears, in miniature, an almost exact resemblance to a catherine-wheel, hence the specific name.

CERITHIUM VERECUNDUM†, sp. n. (Pl. B. fig. 5.)

C. testa parva, solidiuscula, eleganter fusiformi, attenuata, pallide straminea ; anfractibus decem, quorum apicales duo fusci, non hyalini, cæteris apud

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* Deshayes, Encyclop. Method. vol. iii. p. 659.

† *Verecundus*, modest.

suturas multum impressis, tumidulis, tribus liris spiralibus, ultimo quatuor omnino accinctis, longitudinaliter costulis obliquis decoratis, ad juncturas costularum lirarumque gemmuliferis, gemmulis lævibus, nitidis, anfractibus hic illic variciferis; apertura oblonga, labro paullum incrassato, apud basim prolongato, columella fere recta.

Long. 4·20, lat. 1 mm. (sp. maj.)

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A fairly abundant little species, which may be distinguished by its pale straw-colour, irregular varices, channelled sutures, and gemmuled liræ. The most frequent form, however, is smaller than that selected for the type, the apex and general shape being the same, while the whorls are less ventricose, and there is rarely to be seen any trace of varices. This small form may possibly be a separate, very nearly allied species; if so, the line of demarcation is almost too slight to permit of verbal differentiation.

SCISSURELLA ŒTHERIA, sp. n. (Pl. B. fig. 6.)

S. testa parva, heliciformi, angulatim ovata, obtecte umbilicata, supra depresso-conica, undique alba, delicatissima, eleganter sculpturata; anfractibus 4, quorum apicalis parvus, mamillatus, cæteris infra, juxta suturas, bicarinatis, undique longitudinater oblique tenuiliratis, et spiraliter obscure striatis, sub lente ad juncturas pulchre et minutissime gemmulatis, ultimo ad peripheriam bicarinato, inter carinas ad labrum sinu perlongo, angusto; apertura subrotunda, intus alba, labro ad sinum paullum effuso, margine columellari supra umbilicum angustum extenso.

Alt. 1·28, diam. 2 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

One of two species of *Scissurella* extracted sparingly from shell-sand gathered at the above rich locality, in company with what we are inclined to consider *S. aëdonia*, Watson (*cf.* 'Challenger' Report, xv. p. 114, pl. viii fig. 3, *a*, *b*).

The species before us is exceedingly beautiful and delicate, the surface finely sculptured, with the anal slit narrow and a millimetre in length. There is some affinity to *S. aëdonia*, Watson, from Pernambuco, but our species is far more depressedly conical and the outer lip more prolonged at the base.

FOSSARUS (COUTHOUYIA) UNICARINALIS, sp. n. (Pl. B. fig. 7.)

F. testa minuta, anguste umbilicata, oblonga, nivea, pulcherrime sculpturata, anfractibus quinque, quorum duo læves, vitrei, globosi, apicales, cæteris turritis, undique longitudinaliter tenuiliratis, simul ac spiraliter delicatissime striatis, anfractu penultimo cum ultimo infra, juxta suturas, conspicue unicarinato; carina etiam conspicua circa umbilicum, usque ad basim peristomatis in quo immergitur, succingenda; apertura ovata, peristomate nitido, candido incrassato, planato, margine columellari quoque incrassato.

Long. 3, lat. 2mm.

Hab. Arabian Sea, off Bombay, lat. 18° 48′ N., long. 71° 45′ E., 40 fathoms.

An excessively small pure white *Couthouyia*, but of most distinctive character, the sculpture being remarkably ornate and fine. The last two whorls are sharply keeled, and on the body-whorl another keeled projection surrounding the narrow umbilicus merges at the base with the white, thickened, and flattened peristome. Aperture ovate, columellar margin thickened.

ADEORBIS AXIOTIMUS,[*] sp. n. (Pl. B. fig. 8.)

A. testa paullum depressa, profunde umbilicata, alba, delicata, subpellucida anfractibus 4, quorum apicalis fere immersus, minutus, huic proximus anfractus magnopere inflatus, nitidulus, ultimo cæteros multum exsuperante, undique cum penultimo, tenuissime longitudinaliter striato ; apertura magna, ovato-rotunda, labro tenui, simplici, continuo.

Alt. 75 diam. 2 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Very delicate and subtransparent ; the apical whorl is almost immersed and depressed owing to the tumidity of the next, which is shining and almost smooth, the last whorls being beautifully and finely striate.

ERATO RECONDITA,[†] sp. n. (Pl. B. fig. 9.)

E. testa parva, nitida, alba, lævissima, tenui ; anfractibus 5½, apicali obtuso mamillato, cæteris lævibus, immaculatis, ultimo magnopere exsuperante ; apertura angusta, labro supra paullum effuso, nitido, albo, incrassato, intus minute denticulato.

Long. 5, lat. 3mm. (sp. maj.).

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Var. (vel sp.?) *HAPLOCHILA*, nov. (Pl. B. fig. 10.)

E. testa ut supra, sed labro intus simplici, plano, nequaquam denticulato.

Hab. Gulf of Oman, cum præcedente.

Although this var. is not denticulate in the inner side of the lip, we cannot disassociate the two forms of this interesting *Erato*. It is evidently benthal in its habit, and the discovery of more specimens may furnish links to bind these two forms yet closer together.

EULIMA DECAGYRA, sp. n. (Pl. B. fig. 11.)

E. testa minutissima, candida, polita, fusiformi, superne multum attenuata ; anfractibus 10, apicali obtuso, diaphano, pernitido, cæteris applanatis, politis, ultimo basim versus ovato, solidiusculo ; apertura parva, ovata, labro paullum incrassato ; columella declivi, apud basim angulatim incrassata, nitida.

Long. 2·75, lat. 1mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A shining, white, polished species, noteworthy for its gradually attenuate spire, ovate thickened base, and aperture proportionately small. We do not know any *Eulima* exactly comparable nor, we may add, so minute. We are indebted to Mr. Sykes for having extricated two examples from a mass of shell-sand.

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[*] *ἀξιότιμος*, worthy of honour.

[†] *Reconditus*, hidden

*RISSOINA ISOSCELES**, sp. n. (Pl. B. fig. 12.)

R. testa eleganter attenuato-fusiformi, cinereo-alba, solidula; anfractibus 9, quorum 3 apicales hyalini, bulboso-globulares, cæteris longitudinaliter arcte costulatis, apud supernos magis fortibus, paucioribus, undique sub lente spiraliter tenuissime striatis, infra peripheriam ultimi anfractus angulatam evanidis; apertura ovata, labro effuso, basim versus paullum producto, incrassato columella obliqua.

Long. 5·25, lat. 2 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

An attenuate graceful species of the typical section of the genus, angled below the periphery, nine-whorled, the three globularly bulbous apical whorls being distinctive, the longitudinal ribs on the fourth and fifth whorls being fewer and more pronounced than on the lower—indeed they become obsolete below the periphery of the body-whorl. With a lens the delicate spiral striation is discernible. Mouth triangularly ovate, outer lip produced at the base.

RISSOINA (ZEBINA) REGISTOMOIDES, sp. n. (Pl. B. fig. 13)

R. testa perminima, globulari, solidula, lævissima, nitida; anfractibus 5 quorum apicalis obtusus, vitreus, cæteris apud suturas subimpressis, ventricosulis, ultimo paullum effuso, obliquato; apertura ovato rotunda, labro incrassato, albo, nitente.

Long. 2·25, lat. 1·50, mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Very minute, but extremely interesting. We are indebted to Mr. E. R. Sykes for its discovery, while sorting shell-sand received from the above most rich dredging. It is much smaller and more globose than any *Zebina* yet described; the peristome is wonderfully incrassate for so small a shell and quite simple, never dentate, thus being unlike any of the numerous varieties of *R. tridentata*, Mich., = *Eulima curta*, Sowb. The facies is eulimoid, but it possesses the apex of *Rissoina*, and we are satisfied as to its location here. The trivial name is suggested by its form, when magnified, though more globular, somewhat resembling terrestrial *Registoma fuscum*, Gray.

EULIMELLA CARMANICA, sp. n. (Pl. B. fig. 14.)

E. testa minuta, fusiformi, albo-lactea, lævissima, polita, tenui; anfractibus 8–10, quorum apicales heterostrophi, hyalini, lactei, cæteris fere rectis, apud suturas leniter canaliculatis, supernis paullum gradatis, ultimo recto, prolongato; apertura quadratorotunda, labro recto; collumella obliqua, simplici.

Long. 4, lat. 1·20 mm.

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* ἰσοσκελής, from the basal shouldered angles.

Hab. Gulf of Oman, lat. 24° 58° N., long. 56° 54′ E., 156 fathoms.

A pure white, polished, fusiform species, very slightly attenuate; upper whorls gradate, all slightly channelled suturally, more or less straight. Mouth somewhat square, outer lip porrect, squarely produced at the base. Columella oblique, simple. Several specimens occurred. Not so elegant as *E. kaisensis*, Melv., the only other of the genus yet recorded from this region. "Carmania," from whence the specific name is taken, is the ancient name of that portion of Persia impinging on the northern shores of the Gulf of Oman.

(To be continued.)

LIST OF INDIAN BIRDS' EGGS

IN THE BOMBAY NATURAL HISTORY SOCIETY'S COLLECTION ON 1ST SEPTEMBER 1904.

No. of Species.	No. in F., Brit. India.	Scientific Name.	English Name.	No. of Eggs.
		Order I—PASSERES.		
		Family—CORVIDÆ.		
		Sub-family—CORVINÆ.		
1	1	*Corvus corax*	The Raven	4
2	4	,, *macrorhynchus*	The Jungle-Crow	2
3	7	,, *splendens*	The Indian House-Crow	4
4	8	,, *insolens*	The Burmese House-Crow	4
5	10	*Pica rustica*	The Magpie	5
6	12	*Urocissa occipitalis*	The Red-billed Blue Magpie	2
7	14	*Cissa chinensis*	The Green Magpie	3
8	16	*Dendrocitta rufa*	The Indian Tree-pie	4
9	18	,, *himalayensis*	The Himalayan Tree-pie	6
10	19	,, *frontalis*	The Black-browed Tree-pie	2
		Sub-family PARINÆ.		
11	31	*Parus atriceps*	The Indian Grey Tit	4
12	34	,, *monticola*	The Green-backed Tit	3
13	35	*Ægithaliscus erythrocephalus*	The Red-headed Tit	1
14	61	*Scæorhynchus gularis*	The Hoary-headed Crow-Tit	3
		Family—CRATEROPODIDÆ.		
		Sub-family CRATEROPODINÆ		
15	62	*Dryonastes ruficollis*	The Rufous-necked Laughing-Thrush	3
16	69	*Garrulax leucolophus*	The Himalayan White-crested Laughing-Thrush	2
17	72	,, *pectoralis*	The Black-gorgeted Laughing-Thrush.	5
18	73	,, *moniliger*	The Necklaced Laughing-Thrush	6
19	74	,, *gularis*	McClelland's Laughing-Thrush	4
20	80	*Ianthocincla rufigularis*	The Rufous-chinned Laughing-Thrush	1
21	84	*Trochalopterum chrysopterum*	The Eastern Yellow-winged Laughing-Thrush	3
22	87	,, *phœniceum*	The Crimson-winged Laughing-Thrush	1
23	91	,, *simile*	The Western Variegated Laughing-Thrush	2
24	93	,, *cachinnans*	The Nilgiri Laughing-Thrush	2
25	98	,, *virgatum*	The Manipur Streaked Laughing-Thrush	1
26	103	*Stactocichla merulina*	The Spotted-breasted Laughing-Thrush	3
27	105	*Argya caudata*	The Common Babbler	4
28	106	,, *gularis*	The White-throated Babbler	4
29	107	,, *malcolmi*	The Large Grey Babbler	4
30	110	*Crateropus canorus*	The Jungle Babbler	3
31	116	*Pomatorhinus schisticeps*	The Slaty-headed Scimitar Babbler	3
32	121	,, *obscurus*	Hume's Scimitar Babbler	2
33	122	,, *ferruginosus*	The Coral-billed Scimitar Babbler	1

No. of Species.	No. in F., Brit. India.	Scientific Name.	English Name.	No. of Eggs.
		Sub-family—TIMELIINÆ.		
34	134	*Timelia pileata*	The Red-capped Babbler	1
35	135	*Dumetia hyperythra*	The Rufous-bellied Babbler	2
36	139	*Pyctorhis sinensis*	The Yellow-eyed Babbler	4
37	142	*Pellorneum mandellii*	Mandelli's Spotted Babbler	4
38	144	„ *ruficeps*	The Spotted Babbler	2
39	148	„ *ignotum*	The Assam Babbler	4
40	151	*Drymocataphus tickelli*	Tickell's Babbler	2
41	163	*Alcippe nepalensis*	The Nepal Babbler	5
42	164	„ *phæocephala*	The Nilgiri Babbler	3
43	165	„ *phayrii*	The Burmese Babbler	4
44	169	*Stachyrhis nigriceps*	The Black-throated Babbler	2
45	170	„ *chrysæa*	The Golden-headed Babbler	3
46	172	*Stachyrhidopsis ruficeps*	The Red-headed Babbler	3
		Sub-family BRACHYPTERYGINÆ.		
47	187	*Myiophoneus temmincki*	The Himalayan Whistling-Thrush	4
48	189	„ *horsfieldi*	The Malabar Whistling-Thrush	3
49	191	*Larvivora brunnea*	The Indian Blue Chat	2
50	194	*Brachypteryx rufiventris*	The Rufous-bellied Short-wing	2
51	198	*Drymochares nepalensis*	The Nepal Short-wing	8
52	199	*Hodgsonius phœnicuroides*	Hodgson's Short-wing	2
53	201	*Tesia cyaniventris*	The Slaty-bellied Short-wing	2
		Sub-family—SIBIINÆ.		
54	211	*Actinodura egertoni*	The Rufous Barwing	4
55	225	*Yuhina nigrimentum*	The Black-chinned Yuhina	2
56	226	*Zosterops palpebrosa*	The Indian White-eye	6
57	228	„ *simplex*	Swinhoe's White-eye	3
58	232	*Ixulus flavicollis*	The Yellow-naped Ixulus	3
		Sub-family—LIOTRICHINÆ.		
59	243	*Ægithina tiphia*	The Common Iora	3
60	245	„ *nigrilutea*	Marshall's Iora	2
61	252	*Chloropsis jerdoni*	Jerdon's Chloropsis	1
62	257	*Mesia argentauris*	The Silver-eared Mesia	5
63	261	*Psaroglossa spiloptera*	The Spotted-wing	2
64	262	*Hypocolius ampelinus*	The Grey Hypocolius	4
		Sub-family—BRACHYPODINÆ.		
65	263	*Criniger flaveolus*	The White-throated Bulbul	2
66	269	*Hypsipetes psaroides*	The Himalayan Black Bulbul	1
67	272	*Hemixus flavala*	The Brown-eared Bulbul	4
68	278	*Molpastes hæmorrhous*	The Madras Red-vented Bulbul	4
69	279	„ *burmanicus*	The Burmese Red-vented Bulbul	3
70	282	„ *bengalensis*	The Bengal Red-vented Bulbul	3
71	284	„ *leucogenys*	The White-cheeked Bulbul	8
72	288	*Otocompsa emeria*	The Bengal Red-whiskered Bulbul	2
73	289	„ *fuscicaudata*	The Southern Red-whiskered Bulbul	3
74	290	„ *flaviventris*	The Black-crested Yellow Bulbul	2
75	305	*Pycnonotus luteolus*	The White-browed Bulbul	3
76	306	„ *blanfordi*	Blanford's Bulbul	3
		Family—DICRURIDÆ		
77	327	*Dicrurus ater*	The Black Drongo	4
78	328	„ *longicaudatus*	The Indian Ashy Drongo	1
79	333	„ *cineraceus*	The Grey Drongo	4
80	334	*Chaptia ænea*	The Bronzed Drongo	6

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81	335	*Chibia hottentotta*	The Hair-crested Drongo	2
82	339	*Bhringa remifer*	The Lesser Racket-tailed Drongo	6
83	340	*Dissemurus paradiseus*	The Larger Racket-tailed Drongo	2
		Family—CERTHIIDÆ.		
84	347	*Salpornis spilonota*	The Spotted-Grey Creeper	1
85	357	*Pnoepyga pusilla*	The Brown Wren	3
		Family—SYLVIIDÆ.		
86	363	*Acrocephalus stentoreus*	The Indian Great Reed-Warbler	6
87	374	*Orthotomus sutorius*	The Indian Tailor-Bird	8
88	381	*Cisticola cursitans*	The Rufous Fantail-Warbler	6
89	382	*Franklinia gracilis*	Franklin's Wren-Warbler	8
90	383	„ *rufescens*	Beavan's Wren-Warbler	6
91	384	„ *buchanani*	The Rufous-fronted Wren-Warbler.	3
92	394	*Hypotais rama*	Sykes' Tree-Warbler	3
93	399	*Sylvia jerdoni*	The Eastern Orphean Warbler	2
94	402	„ *affinis*	The Indian Lesser White-throated Warbler	1
95	424	*Acanthopneuste magnirostris*	The Large-billed Willow-Warbler	1
96	434	*Cryptolopha xanthoschista*	Hodgson's Grey-headed Flycatcher-Warbler	3
97	448	*Horornis fortipes*	The Strong-footed Bush-Warbler	3
98	458	*Suya crinigera*	The Brown Hill-Warbler	1
99	463	*Prinia flaviventris*	The Yellow-bellied Wren-Warbler.	4
100	464	„ *socialis*	The Ashy Wren-Warbler	4
101	465	„ *sylvatica*	The Jungle Wren-Warbler	6
102	466	„ *inornata*	The Indian Wren-Warbler	5
		Family—LANIIDÆ.		
		Sub-family—LANIINÆ.		
103	469	*Lanius lahtora*	The Indian Grey Shrike	8
104	473	„ *vittatus*	The Bay-backed Shrike	7
105	474	„ *collurioides*	The Burmese Shrike	4
106	475	„ *nigriceps*	The Black-headed Shrike	3
107	476	„ *erythronotus*	The Rufous-backed Shrike	12
108	479	„ *isabellinus*	The Pale-brown Shrike	4
109	488	*Tephrodornis pondicerianus*	The Common Wood-Shrike	3
110	500	*Pericrocotus peregrinus*	The Small Minivet	3
111	501	„ *erythropygius*	The White-bellied Minivet	2
112	510	*Graucalus macii*	The Large Cuckoo-Shrike	1
		Sub-family—ARTAMINÆ.		
113	512	*Artamus fuscus*	The Ashy Swallow Shrike	3
		Family—ORIOLIDÆ.		
114	518	*Oriolus kundoo*	The Indian Oriole	3
		Family—STURNIDÆ.		
115	529	*Sturnus humii*	The Himalayan Starling	4
116	538	*Sturnia malabarica*	The Grey-headed Myna	5
117	539	„ *nemoricola*	The White-winged Myna	4
118	544	*Temenuchus pagodarum*	The Black-headed Myna	5
119	549	*Acridotheres tristis*	The Common Myna	3
120	551	„ *ginginianus*	The Bank Myna	3
121	552	*Æthiopsar fuscus*	The Jungle Myna	1
122	553	„ *grandis*	The Siamese Myna	2

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123	555	*Sturnopastor contra*	The Pied Myna	3
124	556	„ *superciliaris*	The Burmese Pied Myna	7
		Family—MUSCICAPIDÆ.		
125	568	*Cyornis superciliaris*	The White-browed Blue Flycatcher.	3
126	575	„ *rubeculoides*	The Blue-throated Flycatcher	5
127	576	„ *tickelli*	Tickell's Blue Flycatcher	3
128	579	*Stoparola melanops*	The Verditer Flycatcher	3
129	581	„ *albicaudata*	The Nilgiri Blue Flycatcher	4
130	588	*Alseonax latirostris*	The Brown Flycatcher	4
131	590	„ *muttui*	Layard's Flycatcher	1
132	591	*Ochromela nigrirufa*	The Black and Orange Flycatcher	2
133	592	*Culicicapa ceylonensis*	The Grey-headed Flycatcher	2
134	595	*Niltava macgrigoriæ*	The Small Niltava	2
135	598	*Terpsiphone paradisi*	The Indian Paradise Flycatcher	7
136	599	„ *affinis*	The Burmese Paradise Flycatcher	5
137	601	*Hypothymis azurea*	The Indian Black-naped Flycatcher	6
138	604	*Rhipidura albifrontata*	The White-browed Fantail Flycatcher	3
139	605	„ *albicollis*	The White-throated Fantail Flycatcher	2
140	607	„ *pectoralis*	The White-spotted Fantail Flycatcher	3
		Family—TURDIDÆ.		
		Sub-family—SAXICOLINÆ.		
141	608	*Pratincola caprata*	The Common Pied Bush-Chat	3
142	609	„ *atrata*	The Southern Pied Bush-Chat	4
143	615	*Oreicola ferrea*	The Dark-grey Bush-Chat	3
144	618	*Saxicola picata*	The Pied Chat	6
145	628	„ *chrysopygia*	The Red-tailed Chat	2
146	629	*Cercomela fusca*	The Brown Rock-Chat	7
		Sub-family—RUTICILLINÆ.		
147	631	*Henicurus guttatus*	The Eastern Spotted Forktail	3
148	632	„ *schistaceus*	The Slaty-backed Forktail	2
149	633	„ *immaculatus*	The Black-backed Forktail	3
150	644	*Ruticilla rufiventris*	The Indian Redstart	2
151	659	*Notodela leucura*	The White-tailed Blue Robin	2
152	661	*Thamnobia cambaiensis*	The Brown-backed Indian Robin	2
153	662	„ *fulicata*	The Black-backed Indian Robin	8
154	663	*Copsychus saularis*	The Magpie-Robin	8
		Sub-family—TURDINÆ.		
155	667	*Merula simillima*	The Nilgiri Black-Bird	3
156	671	„ *nigripileus*	The Black-capped Black-Bird	5
157	673	„ *castanea*	The Grey-headed Ouzel	3
158	676	„ *boulboul*	The Grey-winged Ouzel	1
159	678	„ *unicolor*	Tickell's Ouzel	4
160	683	*Geocichla wardi*	The Pied Ground-Thrush	3
161	685	„ *cyanonotus*	The White-throated Ground-Thrush.	2
162	686	„ *citrina*	The Orange-headed Ground-Thrush.	4
163	691	*Petrophila cinclorhyncha*	The Blue-headed Rock-Thrush	3
164	693	„ *cyanus*	The Western Blue Rock-Thrush	2
165	695	*Turdus viscivorus*	The Missel-Thrush	1
166	699	*Oreocincla nilgiriensis*	The Nilgiri Thrush	1
167	705	*Zoothera marginata*	The Lesser Brown Thrush	3

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		Family—PLOCEIDÆ.		
		Sub-family—PLOCEINÆ.		
168	720	*Ploceus baya*	The Baya	3
169	721	,, *megarhynchus*	The Eastern Baya	3
170	722	,, *bengalensis*	The Black-throated Weaver-Bird	3
171	723	,, *manyar*	The Striated Weaver-Bird	9
		Sub-family—VIDUINÆ.		
172	726	*Munia atricapilla*	The Chestnut-bellied Munia	2
173	727	*Uroloncha acuticauda*	Hodgson's Munia	1
174	734	,, *malabarica*	The White-throated Munia	9
175	735	,, *punctulata*	The Spotted Munia	2
176	738	*Sporæginthus amandava*	The Indian Red Munia	6
		Family—FRINGILLIDÆ.		
		Sub-family—COCCOTHRAUSTINÆ.		
177	740	*Coccothraustes humii*	Hume's Hawfinch	2
		Sub-family—FRINGILLINÆ.		
178	775	*Gymnorhis flavicollis*	The Yellow-throated Sparrow	4
179	776	*Passer domesticus*	The House-Sparrow	5
180	779	,, *montanus*	The Tree-Sparrow	7
181	780	,, *cinnamomeus*	The Cinnamon Tree-Sparrow	4
182	781	,, *flaveolus*	The Pegu House-Sparrow	3
		Sub-family—EMBERIZINÆ.		
183	803	*Melophus melanicterus*	The Crested Bunting	4
		Family—HIRUNDINIDÆ.		
184	809	*Cotile sinensis*	The Indian Sand-Martin	3
185	811	*Ptyonoprogne concolor*	The Dusky Crag-Martin	2
186	813	*Hirundo rustica*	The Swallow	6
187	814	,, *gutturalis*	The Eastern Swallow	2
188	818	,, *smithii*	The Wire-tailed Swallow	6
189	819	*Hirundo fluvicola*	The Indian Cliff-Swallow	10
190	823	,, *erythropygia*	Sykes' Striated Swallow	2
		Family—MOTACILLIDÆ.		
191	830	*Motacilla hodgsoni*	Hodgson's Pied Wagtail	4
192	831	,, *maderaspatensis*	The Large Pied Wagtail	6
193	836	,, *feldeggi*	The Black-headed Wagtail	1
194	847	*Anthus rufulus*	The Indian Pipit	1
195	853	*Oreocorys sylvanus*	The Upland Pipit	3
		Family—ALANDIDÆ.		
196	871	*Mirafra erythroptera*	The Red-winged Bush-Lark	2
197	873	,, *microptera*	The Burmese Bush-Lark	3
198	874	*Galerita cristata*	The Crested Lark	3
199	875	,, *deva*	Sykes' Crested Lark	2
200	877	*Ammomanes phœnicura*	The Rufous-tailed Finch-Lark	3
201	879	*Pyrrhulauda grisea*	The Ashy-crowned Finch-Lark	2

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		Family—NECTARINIIDÆ.		
		Sub-family—NECTARINIINÆ.		
202	895	*Arachnechthra asiatica*	The Purple Sun-Bird	3
203	900	„ *minima*	The Small Sun-Bird	4
204	901	„ *zeylonica*	The Purple-rumped Sun-Bird	2
		Sub-family—ARACHNOTHERINÆ.		
205	906	*Arachnothera magna*	The Larger-Streaked Spider-hunter	2
		Family—DICÆIDÆ.		
206	921	*Piprisoma squalidum*	The Thick-billed Flower-pecker	6
		Family—PITTIDÆ.		
207	927	*Pitta nepalensis*	The Blue-naped Pitta	3
208	933	„ *brachyura*	The Indian Pitta	2
		Order II—EURYLÆMI.		
		Family—EURYLÆMIDÆ.		
209	942	*Serilophus lunatus*	Gould's Broadbill	4
210	943	„ *rubripygius*	Hodgson's Broadbill	4
211	944	*Psarisomus dalhousiæ*	The Long-tailed Broadbill	4
		Order III—PICI.		
		Family—PICIDÆ.		
		Sub-family—PICINÆ.		
212	950	*Gecinus occipitalis*	The Black-naped Green Woodpecker.	6
213	951	„ *chlorolophus*	The Small Himalayan Yellow-naped Woodpecker	4
214	972	*Liopicus mahrattensis*	The Yellow-fronted Pied Woodpecker	2
215	986	*Brachypternus aurantius*	The Golden-backed Woodpecker	3
216	992	*Crysocolaptes gutticristatus*	Tickell's Golden-backed Woodpecker.	1
		Sub-family—PICUMNINÆ.		
217	1001	*Picumnus innominatus*	The Speckled Piculet	1
		Order IV—ZYGODACTYLI.		
		Family—CAPITONIDÆ.		
218	1007	*Megælama virens*	The Great Chinese Barbet	1
219	1008	*Thereiceryx zelonicus*	The Common Indian Green Barbet	5
220	1012	*Cyanops asiatica*	The Blue-throated Barbet	3
221	1017	„ *franklini*	The Golden-throated Barbet	2
222	1019	*Xantholæma hæmatocephala*	The Crimson-breasted Barbet or Coppersmith	3
		Order V—ANISODACTYLI.		
		Sub-order—CORACIÆ.		
		Family—CORACIADÆ.		
223	1022	*Coracias indica*	The Indian Roller	5
224	1023	„ *affinis*	The Burmese Roller	1
225	1024	„ *garrula*	The European Roller	1

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		Sub-order—MEROPES.		
		Family—MEROPIDÆ.		
226	1026	*Merops viridis*	The Common Indian Bee-eater ...	3
227	1027	,, *philippinus*	The Blue-tailed Bee-eater	1
228	1029	,, *apiaster*	The European Bee-eater	4
		Sub-order—HALCYONES.		
		Family—ALCEDINIDÆ.		
229	1033	*Ceryle varia*	The Indian Pied Kingfisher	6
230	1035	*Alcedo ispida*	The Common Kingfisher	5
231	1044	*Halcyon smyrnensis*	The White-breasted Kingfisher ...	2
		Sub-order—BUCEROTES.		
		Family—BUCEROTIDÆ.		
232	1062	*Lophoceros birostris*	The Common Grey Hornbill ...	2
233	1065	*Rhinoplax vigil*	The Helmeted Hornbill	1
		Sub-order—UPUPÆ.		
		Family—UPUPIDÆ.		
234	1066	*Upupa epops*	The European Hoopoe	4
		Order VI—MACROCHIRES.		
		Sub-order—CYPSELI.		
		Family—CYPSELIDÆ.		
		Sub-family—CYPSELINÆ.		
235	1073	*Cypselus affinis*	The Common Indian Swift	8
236	1075	*Tachornis batassiensis*	The Palm-Swift	3
237	1076	,, *infumatus*	The Eastern Palm-Swift	4
		Sub-family—CHÆTURINÆ.		
238	1081	*Collocalia fuciphaga*	The Indian Edible-nest Swiftlet ...	2
		Sub-order—CAPRIMULGI.		
		Family—CAPRIMULGIDÆ.		
239	1090	*Caprimulgus monticola*	Franklin's Nightjar	2
240	1091	,, *asiaticus*	The Common Indian Nightjar ...	4
241	1093	,, *macrurus*	Horsfeld's Nightjar	2
		Sub-order—PODARGI.		
		Family—PODARGIDÆ.		
242	1097	*Batrachostomus hodgsoni* ...	Hodgson's Frogmouth	1
		Order VII—TROGONES.		
		Family—TROGONIDÆ.		
243	1101	*Harpactes erythrocephalus* ...	The Red-headed Trogon	3

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		Order VIII—COCCYGES.		
		Family—CUCULIDÆ.		
		Sub-family—CUCULINÆ.		
244	1104	*Cuculus canorus*	The Cuckoo	1
245	1118	*Coccystes jacobinus*	The Pied Crested Cuckoo	4
		Sub-family—PHŒNICOPHAINÆ.		
246	1120	*Eudynamis honorata*	The Indian Koel	4
247	1123	*Rhopodytes tristis*	The Large Green-billed Malkoha	2
248	1129	*Taccocua leschenaulti*	The Sirkeer Cuckoo	3
249	1130	*Centropus sinensis*	The Common Coucal or Crow-Pheasant	4
250	1133	,, *bengalensis*	The Lesser Coucal	2
		Order IX—PSITTACI.		
		Family—PSITTACIDÆ.		
251	1138	*Palæornis torquatus*	The Rose-ringed Paroquet	3
252	1139	,, *cyanocephalus*	The Western Blossom-headed Paroquet	3
253	1141	,, *schisticeps*	The Slaty-headed Paroquet	2
		Order X—STRIGES.		
		Family—ASIONIDÆ.		
		Sub-family—BUBONINÆ.		
254	1164	*Ketupa zeylonensis*	The Brown Fish-Owl	2
255	1168	*Bubo bengalensis*	The Rock Horned Owl	3
256	1169	,, *coromandus*	The Dusky Horned Owl	1
257	1180	*Athene brama*	The Spotted Owlet	4
258	1184	*Glaucidium radiatum*	The Jungle Owlet	1
		Order XI—ACCIPITRES.		
		Family—VULTURIDÆ.		
259	1190	*Vultur monachus*	The Cinereous Vulture	2
260	1191	*Otogyps calvus*	The Black Vulture or Pondicherry Vulture	1
261	1192	*Gyps fulvus*	The Griffon Vulture	2
262	1194	,, *indicus*	The Indian Long-billed Vulture	1
263	1196	*Pseudogyps bengalensis*	The Indian White-backed Vulture	1
264	1197	*Neophron ginginianus*	The Smaller White Scavenger Vulture	2
265	1198	,, *percnopterus*	The Egyptian Vulture or Large White Scavenger Vulture	3
		Family—FALCONIDÆ.		
		Sub-family—GYPÆTINÆ.		
266	1199	*Gypaëtus barbatus*	The Bearded Vulture or Lämmergeyer	1
		Sub-family—FALCONINÆ.		
267	1200	*Aquila chrysaëtus*	The Golden Eagle	2
268	1203	,, *vindhiana*	The Indian Tawny Eagle	2
269	1207	*Hieraëtus fasciatus*	Bonelli's Eagle	1

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270	1216	*Circaëtus gallicus*	The Short-toed Eagle	1
271	1220	*Butastur teesa*	The White-eyed Buzzard-Eagle	2
272	1223	*Haliaëtus leucoryphus*	Pallas's Fishing-Eagle	2
273	1224	„ *leucogaster*	The White-bellied Sea-Eagle	1
274	1226	*Polioaëtus ichthyaëtus*	The Large Grey-headed Fishing-Eagle	2
275	1228	*Haliastur indus*	The Brahminy Kite	2
276	1229	*Milvus govinda*	The Common Pariah Kite	2
277	1231	„ *migrans*	The Black Kite	4
278	1232	*Elanus cæruleus*	The Black-winged Kite	4
279	1239	*Buteo ferox*	The Long-legged Buzzard	2
280	1241	*Astur badius*	The Shikra	4
281	1247	*Accipiter nisus*	The Sparrow-Hawk	3
282	1257	*Falco jugger*	The Laggar Falcon	2
283	1260	„ *subbuteo*	The Hobby	1
284	1264	*Æsalon chicquera*	The Turumti or Red-headed Merlin	3
285	1265	*Tinnunculus alaudarius*	The Kestrel	7
		Order XII—COLUMBÆ.		
		Family—COLUMBIDÆ.		
		Sub-family—TRERONINÆ.		
286	1273	*Osmotreron phayrei*	The Ashy-headed Green Pigeon	2
287	1278	„ *bicincta*	The Orange-breasted Green Pigeon	1
288	1281	*Treron nepalensis*	The Thick-billed Green Pigeon	2
289	1282	*Sphenocercus apicicauda*	The Pin-tailed Green Pigeon	4
290	1283	„ *sphenurus*	The Kokla Green Pigeon	3
		Sub-family—PHABINÆ.		
291	1291	*Chalcophaps indica*	The Bronze-winged Dove	2
		Sub-family—COLUMBINÆ.		
292	1292	*Columba intermedia*	The Indian Blue Rock-Pigeon	3
293	1309	*Turtur cambayensis*	The Little Brown Dove	3
294	1310	„ *risorius*	The Indian Ring-Dove	4
295	1312	*Macropygia tusalia*	The Bar-tailed Cuckoo-Dove	1
		Order XIII—PTEROCLETES.		
		Family—PTEROCLIDÆ.		
296	1321	*Pteroclurus exustus*	The Common Sand-grouse	3
		Order XIV—GALLINÆ.		
		Sub-order—ALECTOROPODES.		
		Family—PHASIANIDÆ.		
297	1324	*Pavo cristatus*	The Common Peafowl	1
298	1325	„ *muticus*	The Burmese or Javan Peafowl	1
299	1328	*Gallus ferrugineus*	The Red Jungle-fowl	4
300	1330	„ *sonnerati*	The Grey Jungle-fowl	1
301	1336	*Gennæus albicristatus*	The White-crested Kalij Pheasant	6
302	1339	„ *horsfieldi*	The Black-breasted Kalij Pheasant.	1
303	1342	*Lophophorus refulgens*	The Monal	1
304	1349	*Galloperdix spadicea*	The Red Spur-fowl	5
305	1351	„ *bicalcarata*	The Ceylon Spur-fowl	2
306	1352	*Bambusicola fytchii*	The Western Bamboo-Partridge	3

No. of Species.	No. in F., Brit. India.	Scientific Name.	English Name.	No. of Eggs.
307	1356	*Coturnix coromandelica*	The Black-breasted or Rain Quail	5
308	1363	*Arboricola rufigularis*	Blyth's Hill-Partridge	2
309	1364	„ *intermedia*	The Arrakan Hill-Partridge	3
310	1365	„ *atrigularis*	The White-cheeked Hill-Partridge	2
311	1370	*Caccabis chucar*	The Chukor	10
312	1371	*Ammoperdix bonhami*	The Seesee	4
313	1372	*Francolinus vulgaris*	The Black Partridge or Common Francolin	1
314	1373	„ *pictus*	The Painted Partridge	1
315	1374	„ *chinensis*	The Eastern or Chinese Francolin	4
316	1375	„ *pondicerianus*	The Grey Partridge	2
317	1377	*Perdix hodgsoniae*	The Tibetan Partridge	6
318	1378	*Tetraogallus himalayensis*	The Himalayan Snow-Cock	2
		Sub-order—Peristeropodes.		
		Family—Megapodiidæ.		
319	1381	*Megapodius nicobariensis*	The Nicobar Megapode	1
		Order XV—Hemipodii.		
		Family—Turnicidæ.		
320	1382	*Turnix pugnax*	The Bustard-Quail	4
		Order XVI—Grallæ.		
		Sub-order—Fulicariæ.		
		Family—Rallidæ.		
321	1389	*Hypotænidia striata*	The Blue-breasted Banded Rail	6
322	1395	*Rallina superciliaris*	The Banded Crake	5
323	1398	*Amaurornis fuscus*	The Ruddy Crake	1
324	1400	„ *akool*	The Brown Crake	3
325	1401	„ *phœnicurus*	The White-breasted Water-Hen	6
326	1402	*Gallinula chloropus*	The Moorhen	7
327	1404	*Porphyrio poliocephalus*	The Purple Moorhen	3
328	1405	*Fulica atra*	The Coot	5
		Sub-order—Grues.		
		Family—Gruidæ.		
329	1409	*Grus antigone*	The Sarus	2
		Sub-order—Otides.		
		Family—Otididæ.		
330	1413	*Otis tetrax*	The Little Bustard	1
331	1414	*Eupodotis edwardsi*	The Great Indian Bustard	2
332	1416	*Sypheotis aurita*	The Lesser Florican or Likh	3
		Order XVII—Limicolæ.		
		Family—Œdicnemidæ.		
333	1418	*Œdicnemus scolopax*	The Stone-Curlew	2
334	1419	*Esacus recurvirostris*	The Great Stone-Plover	2

No. of Species.	No. in F., Brit. India.	Scientific Name.	English Name.	No. of Eggs.
		Family—DROMADIDÆ.		
335	1421	*Dromas ardeola*	The Crab-Plover	2
		Family—GLAREOLIDÆ.		
		Sub-family—CURSORIINÆ.		
336	1422	*Cursorius coromandelicus*	The Indian Courser	2
		Sub-family—GLAREOLINÆ.		
337	1427	*Glareola lactea*	The Small Indian Pratincole or Swallow-Plover	6
		Family—PARRIDÆ		
338	1428	*Metopidius indicus*	The Bronze-winged Jacana	5
339	1429	*Hydrophasianus chirurgus*	The Pheasanttailed Jacana	6
		Family—CHARADRIIDÆ.		
		Sub-Family—CHARADRIINÆ.		
340	1431	*Sarcogrammus indicus*	The Red-wattled Lapwing	5
341	1433	*Sarciophorus malabaricus*	The Yellow-wattled Lapwing	3
342	1435	*Hoplopterus ventralis*	The Indian Spur-winged Plover	4
343	1443	*Ægialitis mongolica*	The Lesser Sand-Plover	4
344	1446	,, *alexandrina*	The Kentish Plover	2
345	1447	,, *dubia*	The Little Ringed Plover	2
		Sub-family—HÆMATOPODINÆ.		
346	1451	*Himantopus candidus*	The Black-winged Stilt	1
		Sub-family—TOTANINÆ.		
347	1460	*Totanus hypoleucus*	The Common Sandpiper	1
348	1468	*Pavoncella pugnax*	The Ruff and Reeve	1
349	1476	*Tringa crassirostris*	The Eastern Knot	1
350	1478	,, *alpina*	The Dunlin	2
		Sub-family—SCOLOPACINÆ.		
351	1488	*Rostratula capensis*	The Painted Snipe	3
		Order XVIII—GAVIÆ.		
		Family—LARIDÆ.		
		Sub-family—LARINÆ.		
352	1492	*Larus hemprichi*	The Sooty Gull	3
		Sub-family—STERNINÆ.		
353	1496	*Hydrochelidon hybrida*	The Whiskered Tern	3
354	1498	*Hydroprogne caspia*	The Caspian Tern	3
355	1501	*Sterna media*	The Smaller Crested Tern	3
356	1502	,, *bergii*	The Larger Crested Tern	2
357	1503	,, *seena*	The Indian River-Tern	4
358	1504	,, *melanogaster*	The Black-bellied Tern	4
359	1505	,, *albigena*	The White-cheeked Tern	3

No. of Species.	No. in F., Brit. India.	Scientific Name.	English Name.	No. of Eggs.
360	1508	*Sterna dougalli*	The Roseate Tern	29
361	1510	„ *minuta*	The Little Tern	6
362	1511	„ *saundersi*	The Black-shafted Ternlet	5
363	1513	„ *anœstheta*	The Panayan Tern	4
		Sub-family—RYNCHOPINÆ.		
364	1517	*Rhynchops albicollis*	The Indian Skimmer or Scissors-bill.	8
		Order XIX—STEGANOPODES.		
		Famly—PHALACROCORACIDÆ.		
		Sub-family—PHALACROCORACINÆ.		
365	1526	*Phalacrocorax carbo*	The Large Cormorant	4
366	1527	„ *fuscicollis*	The Indian Shag	2
367	1528	„ *javanicus*	The Little Cormorant	4
		Sub-family—PLOTINÆ.		
368	1529	*Plotus melanogaster*	The Indian Darter or Snake-bird	2
		Order XXI—HERODIONES.		
		Sub-order—PLATALEÆ.		
		Family—IBIDIDÆ.		
369	1541	*Ibis melanocephala*	The White Ibis	2
		Family—PLATALEIDÆ.		
370	1545	*Platalea leucorodia*	The Spoonbill	4
		Sub-order—CICONIÆ.		
		Family—CICONIIDÆ.		
371	1548	*Dissura episcopus*	The White-necked Stork	1
372	1549	*Xenorhynchus asiaticus*	The Black-necked Stork	1
373	1552	*Pseudotantalus leucocephalus*	The Painted Stork	4
374	1553	*Anastomus oscitans*	The Open-bill	3
		Sub-order—ARDEÆ.		
		Family—ARDEIDÆ.		
375	1554	*Ardea manillensis*	The Eastern Purple Heron	4
376	1555	„ *cinerea*	The Common Heron	3
377	1559	*Herodias alba*	The Large Egret	3
378	1560	„ *intermedia*	The Smaller Egret	3
379	1561	„ *garzetta*	The Little Egret	1
380	1562	*Bubulcus coromandus*	The Cattle Egret	2
381	1563	*Lepterodius asha*	The Indian Reef-Heron	4
382	1565	*Ardeola grayi*	The Pond Heron	3
383	1568	*Nycticorax griseus*	The Night Heron	4
384	1570	*Ardetta minuta*	The Little Bittern	2
385	1572	„ *cinnamomea*	The Chestnut Bittern	3

No. of Species.	No. in F., Brit. India.	Scientific Name.	English Name.	No. of Eggs.
		Order XXII—Phœnicopteri.		
		Family—Phœnicopteridæ.		
386	1575	*Phœnicopterus roseus*	The Common Flamingo	4
		Order XXIII—Anseres.		
		Family—Anatidæ.		
		Sub-family—Anatinæ.		
387	1584	*Sarcidiornis melanonotus*	The Comb Duck or Nukta	2
388	1589	*Dendrocycna javanica*	The Whistling Teal	6
389	1590	„ *fulva*	The Large Whistling Teal	2
390	1592	*Anas boscas*	The Mallard	2
391	1593	„ *pœcilorhyncha*	The Spotted-billed Duck	2
392	1606	*Nyroca ferruginea*	The White-eyed Duck	6
393	1614	*Merganser serrator*	The Red-breasted Merganser	4
		Order XXIV—Pygopodes.		
		Family—Podicipedidæ.		
394	1615	*Podicipes cristatus*	The Great Crested Grebe	1
395	1617	„ *albipennis*	The Indian Little Grebe or Dabchick.	4

ON SOME NEW SPECIES OF SILVER-PHEASANTS OBTAINED IN BURMA, BY CAPTAIN W. G. NISBETT, LIEUT. R. CLIFFORD AND OTHERS.

By Eugene W. Oates.

Amongst the pheasants that I have received from Burma during the last two years there are three well-marked new species of Silver-Pheasants. The first two that I shall describe belong to an entirely new section of these birds, in which the males combine a black wing with a barred tail, and the females have the middle tail-feathers with the two webs of different colours. The third species is of remarkable interest, as it has now been rediscovered after an interval of eighty years. The bird was, however, never described nor named, and it was only known from a coloured drawing.

Gennæus obscurus, sp. n.

In the adult male the head, crest, and the whole lower plumage are glossy blue-black. The hind-neck, mantle, back, and all the upper wing-coverts are bluish black, sparingly speckled with pale buff. The rump-feathers and upper tail-coverts are bluish black, broadly margined with white and very sparingly dotted with pale buff on one or both webs. The primaries are brown; the secondaries black, with a few buff specks on the margin of the outer web of each feather. The outermost tail-feather is black; the middle pair black with narrow, broken, diagonal white bars on the whole of both webs, except the terminal quarter of the outer web, the margin of the basal half of the inner web being plain white. The remaining tail-feathers are of an intermediate character, the second from the outside being black with a few specks of white at the base of the outer web and the feather next the middle pair being black with a few diagonal white lines on the basal three-fourths of the outer web.

In another male, which is probably a year younger than the specimen described above, the specks or dots on the upper plumage, wing-coverts, and secondaries are more numerous and form narrow, zigzag, broken lines. The markings on the tail-feathers are less numerous and the middle tail-feathers have the inner web entirely black.

Length of wing 9·25 inches, of tail 11·5 inches. The legs are of a brown colour.

The female resembles the female of *G. Horsfieldi* in all respects, except in the coloration of the tail. The general colour of the plumage is reddish brown, the feathers edged paler and vermiculated in an indistinct manner with black; those of the breast and belly marked with cream-coloured shaft-streaks. The quills of the wing are brown, mottled with fulvous on the outer webs. The outermost tail-feather is entirely black; the next six are also black, the second from the outside having a few white specks at the base of the outer web, the specks increasing in number on each successive feather and gradually combining into narrow wavy bars, the seventh feather being cross-barred all over, except at the tip. The two middle feathers are of a rich dark chestnut on the outer web and of a pale chestnut on the inner, both webs being longitudinally marked with wavy black bars, those on the outer web being much broader than those on the inner. Length of wing 8·5 inches, of tail 9·5 inches. The legs are of a brown colour.

Both sexes of this pheasant were sent to me by Captain W. G. Nisbett from the Katha District of Upper Burma.

Gennæus Cliffordi, sp. n.

In this species the male is unique in being streaked with white on the mantle and the female is remarkable in having black spots on some of the feathers of the wing.

In a very old male the head, crest, and the whole of the lower plumage are glossy blue-black. The hind-neck and mantle are black, each feather with a narrow streak, which is white mottled with black, and about an inch in length. The upper back is plain black. The lower back and rump are black, each feather with a white margin and one or two broken white vermiculations just above the margin. The primaries are dark brown; the secondaries black, with a few white specks on the margins of the outer webs of the outermost feathers. The upper wing-coverts are black, a few of the lesser coverts with white shaft-streaks; the inner median and greater coverts with a very narrow but conspicuous white margin. The middle tail-feathers are diagonally marked with equal bands of black and white, the margin of the inner web being plain white. The next feather is black, everywhere banded narrowly with white. The next is black, sparingly marked with broken bars of white. The next, again, is black with a little white at the base only. The four outer feathers are plain black. The upper tail-coverts are black, covered with broken white bands more or less parallel to the margin.

Length of wing 10 inches, of tail nearly 16 inches. The legs are brown.

A young male, with the spurs half-grown, has the plumage of the same character as the bird just described, differing in some details. The streaks on the mantle are large and triangular, extending in some cases to nearly the whole of the feather, and the white much broken up. The upper wing-coverts are speckled with white, and the white margin to the inner median and greater coverts is indistinct. The visible portions of the rump-feathers are black with a broader white margin, but lacking the broken white vermiculations above the margin. On the other hand, there is much white speckling on the concealed portions of the feathers. The middle tail-feathers, which have only a very slight curl outwards, are black, very sparingly banded with white. The next three are still more sparingly marked and the outer four are entirely black.

Length of wing 9·5 inches, of tail nearly 10 inches. The legs are of a brownish flesh-colour.

The female has the upper plumage and wing-coverts of a russet-brown colour, each feather vermiculated with black, the shaft and the margin much paler, some of the inner median and greater coverts with a black patch or large spot near the tip of one or both webs. The primaries are brown; the secondaries brown, vermiculated with black and mottled with rufous, the innermost with a black patch near the tip of the outer webs. The middle tail-feathers are dull chestnut on the inner web, vermiculated with black; and black on the outer web, vermiculated with chestnut on the margin. The other tail-feathers are all black. The lower plumage is black, the margins of the feathers pale brown. Each feather of the breast and belly has a very broad, pointed ochraceous streak, occupying quite half of the feather and in some cases three-quarters, and mottled with black. The feathers of the sides of the body and flanks have bright ochraceous shaft-streaks.

Length of wing 9 inches, of tail 8·5 inches. The legs are pale brown.

Specimens of this pheasant have been sent to me by Lieut. R. Clifford, of the 22nd Punjabis, and I have much pleasure in associating his name with the species. It occurs in the Myitkyina District, east of the Irrawaddy river.

Gennæus assimilis, sp. n.

In the year 1826 Crawfurd went on a mission to the Court of Ava, and in the course of his travels met with a pheasant, of which a coloured drawing was made. So far as I can ascertain, nothing was known of this drawing till Gould reproduced it in the background of his plate of *Diardigallus pralatus* in his "Birds of Asia." I have often looked at this drawing of Gould's and wondered why the artist should have depicted the female of *Gennæus rufipes*, the Ruby Mines Pheasant, with flesh-coloured legs. The mystery was cleared up when I received from the Ruby Mines a bird which corresponded precisely with Gould's figure. On writing to one of my correspondents, I learn that there is in the Ruby Mines District a pheasant with pale legs, very similar in other respects with the red-legged species, and equally well known. I hope, therefore, soon to acquire the male.

The female of the present species has the whole upper plumage and the upper wing-coverts of a uniform umber-brown, the shafts and the margins of the feathers somewhat paler; the crest a darker brown, vermiculated with black; the upper tail-coverts also thickly vermiculated with dark brown. The primaries are dark brown, mottled with fulvous on the outer webs; the secondaries are umber-brown, vermiculated with black. The tail-feathers are diagonally barred and vermiculated with a combination of umber-brown, fulvous, black, and very pale buff, inner webs being darker and more coarsely marked than the outer. The whole lower plumage is dark blackish brown each feather with two broad, zigzag, V-shaped marks of an ochraceous colour, the outer being close to the edge of the feather, the inner much smaller and frequently forming only an irregular and coarse streak on and about the shaft. Length of wing nearly 10 inches; of tail 10 inches. The legs are flesh-coloured.

The main points of difference between the female of this species and those of *G. rufipes*, of which I have a large series, are the flesh-coloured legs, and the absence of black vermiculations on the upper plumage and upper wing-coverts.

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INSECT LIFE IN INDIA AND HOW TO STUDY IT,

BEING

A SIMPLE ACCOUNT OF THE MORE IMPORTANT FAMILIES OF INSECTS WITH EXAMPLES OF THE DAMAGE THEY DO TO CROPS, TEA, COFFEE AND INDIGO CONCERNS, FRUIT AND FOREST TREES IN INDIA,

BY

E. P. STEBBING, F.L.S., F.Z.S., F.E.S.

Continued from Volume 15, *page* 386.

Chapter V.

Order IV —Hymenoptera.

In the adult Insect four membranous wings are present; they have no scales upon them, are usually transparent and never very large, the hinder pair being smaller than the front ones; the cells formed by the nervures in the wing are irregular in size and form, and never very numerous (less than twenty on the front, than fifteen on the hind wing). Mandibles are present and are conspicuous even when the other parts of the mouth, as is often the case, form a proboscis or sucking tube. The females are furnished at the extremity of the body with either a saw, a sting, or an ovipositor; these parts may be either kept withdrawn, when not actually in use, within the body or may be permanently protruded. Metamorphosis is complete, both a grub and pupal stage being present. In the pupal stage the parts of the perfect Insect are seen nearly free, each covered with a very delicate skin. Fig. 33 shows the larva, pupa and imago of a bee (*Bombus*).

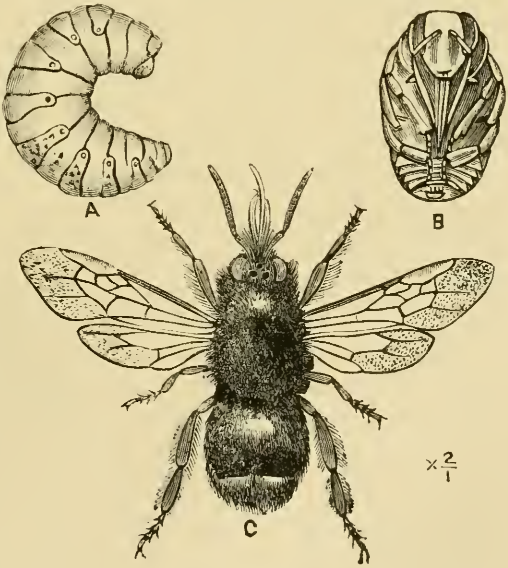

FIG. 33.—*a*, larva; *b*, pupa; *c*, imago of a species of *Bombus*.

The Order Hymenoptera includes the wood-wasps, saw-flies and gall flies, the numerous tribes of the ichneumon flies and chalcid flies, and the ants, bees, and wasps. It is a large Order, in which a very large number of species remain to be discovered and described, and this is especially the case in India.

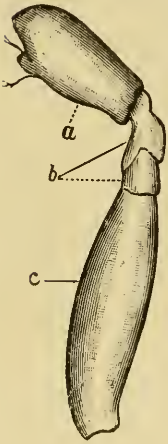

Fig. 34.—Divided trochanter of an Ichneumon: *a*, coxa; *b*, divided trochanter; *c*, femur (after Sharp).

In the adult Insect the head is short and broad and deeply constricted off from the prothorax and never sunk into it; sometimes it is attached to this latter by a stalk-like process. The mandibles are powerful biting organs, and the proboscis is at times of some length, it being used for sucking up sweet liquids into the mouth (fig. 33, *c*) The prothorax is but feebly developed, the dorsal portion being separated from the ventral half, the former being firmly fused to the mesothorax, whilst the lower portion (with the first pair of legs) is movable. Meso- and metathorax are usually immovably united, but in the saw-flies and wood-wasps they are freely movable. The legs have large coxæ, and the trochanter is often divided into two joints (in the *Tenthredinidæ*, *Uroceridæ*, *Cynipidæ* and *Ichneumonidæ*) as seen in fig. 34 which shows the divided trochanter of an ichneumon; the tarsus is five-jointed, the first joint being longer than the following one. The upper and lower wings are connected by a row of small hooks, attached to the upper edge of the lower wing, which catch on to the stout-curved edge of the front wing, the two wings on one side thus acting as one piece. Fig. 35 shows the wings of a carpenter-bee (*Xylocopa*) and

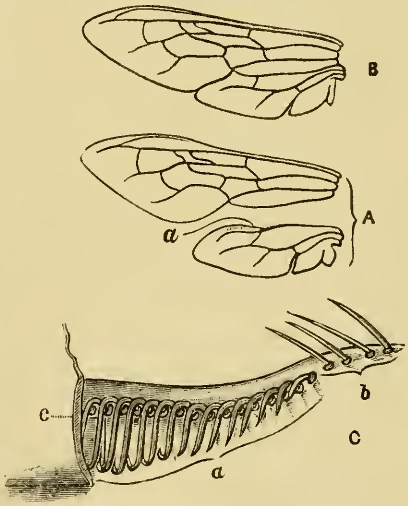

Fig. 35.—Wings of *Xylocopa*. *A*, the pair of wings separated; *a*, the position of the hooks. *B*, the same wings when united by the hooks. *C*, portions of the two wings: *a*, the series of hooks; *b*, marginal hairs; *c*, portion of edge of front wing, of which the other part has been broken away in order to show the hooks.

the way in which they are connected together. In all but the *Tenthredinidæ* and *Siricidæ* there is a deep constriction between what appears to be the thorax and the body (*cf.* figs. 37 *c* and 49). The abdomen is thus said to be *stalked.**

The eggs when being laid pass through the hollow stabbing or boring apparatus at the end of the body of the female, in many cases a prick or cut being made in an animal or plant with this instrument for the reception of the egg. This apparatus may also serve as a sting (*e.g.*, in the wasp).

The grubs are usually white in colour and blind (see fig. 38, *a*); only in the *Tenthredinidæ* and the *Siricidæ* do they resemble the caterpillars of the *Lepidoptera* (butterflies and moths) (*cf.* fig. 39). The larvæ often form cocoons to pupate in.

One of the most remarkable facts connected with this Order is the prevalence of parthenogenesis (or the production of young by the female without the concurrence of the male) in a considerable number of widely separated species. In some members of the Order it is believed that the reproduction is entirely parthenogenetic. In the gall-making *Cynipidæ*, parthenogenesis is frequently accompanied by alternation of generations, a generation consisting of two sexes being followed by another consisting entirely of females, which in its turn gives rise to a bi-sexual generation.

The Order is divided into two very distinct Sub-orders dependant upon the manner in which the abdomen is joined on to the thorax, *viz.* :—

I.—*Hymenoptera Sessiliventres.*—Insects with the abdomen broad at the base, its first segment not completely joined to the thorax.

II.—*Hymenoptera Petiolata.*—The abdomen connected with what appears to be the thorax by the slender joint forming a marked constriction between the apparent thorax and the abdomen.

I.—HYMENOPTERA SESSILIVENTRES.

The abdomen is not stalked but is nearly continuous in outline with the thorax (see fig. 37, *c*). Trochanters are divided into two portions. The saws or boring apparatus at the end of the body of the female are concealed or only just visible. The larva has three pairs of thoracic legs and often numerous abdominal ones (see fig. 39). The food is vegetable, some species feeding in galls on plants, others in the interior of twigs, whilst others again bore into and live in the hard wood of trees and shrubs. The majority, however, live upon the leaves of plants. Those which live in wood resemble coleopterous larvæ in appearance, whilst the species living and feeding upon leaves resemble the leaf-eating lepidopterous caterpillars (see figs. 37*a*, and 39).

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* This constriction really occurs in the first abdominal segment and not in the thorax. This first abdominal segment is firmly fixed to the thorax, and the constriction occurs between it and the second segment of the body.

Fam. I. Cephidæ—Stem Saw-Flies.

Slender Insects with a weak integument and slender antennæ. The female bears a saw at the end of her body. The larvæ live in the stems of plants or in the tender shoots of trees and shrubs.

Little is known about these Insects in India. One, however,—an undescribed species—has been found boring into the bases of the young new needles of the deodar (*Cedrus deodara*) in the spring. The needles of this tree develop on the branches in small rosettes (fig. 36, *c*). If these small spine-like leaves be examined when attacked by this minute insect, they will be seen to have swollen up at their bases in such a manner that the needles coalesce at the bottom as seen in *c*. A closer examination shows that the swelling is convex on the outside, concave on the inner one (fig. 36, *d*), and in this small concave elliptical depression a tiny orange yellow grub will be found. This is the larva of this small cephid and is shown in fig. 36*a*. The irritation set up by its feeding operations causes the swelling at the base of the

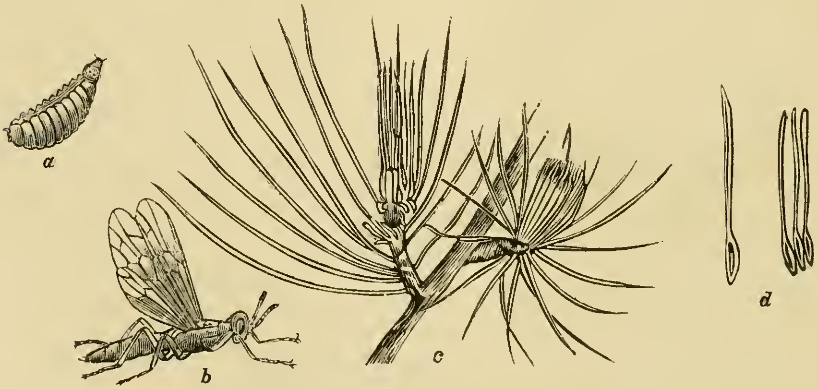

FIG. 36—Cephus ? sp. *a* larva ; *b* imago ; *c*, Deodar branch showing effects of larval attacks; *d*, attacked needles with bases swollen up. *a*, and *b*, much enlarged (N.-W. Himalayas).

needle; from four to six weeks are spent in the larval stage. The pupal stage is a short one, and about the middle of June or beginning of July the tiny brilliant metallic blue flies shown in fig. 36, *b*, issue. The length of this insect is $\frac{1}{16}$th of an inch only. The attacked rosettes turn yellow and die, and occasionally a considerable amount of defoliation is accomplished in this manner on young deodar saplings in the North-West Himalayas.

We have yet much to learn about the members and life histories of this family.

Fam. II. Siricidæ or Uroceridæ—Wood-Wasps.

Large Insects of bright conspicuous colours; the female is provided with an elongate cylindrical boring instrument at the extremity of the body. Antennæ are filiform and elongate; the abdomen has eight dorsal plates, and the tibia of the front leg is provided with a spur; the anal lobe of the posterior wing is large. The larvæ live in wood, in which they gnaw long winding passages; they are blind yellowish-white grubs, with three pairs of short thoracic legs but have no abdominal legs. The pupa (see fig. 37, *d*) is naked—that is, it is not enclosed in any cocoon.

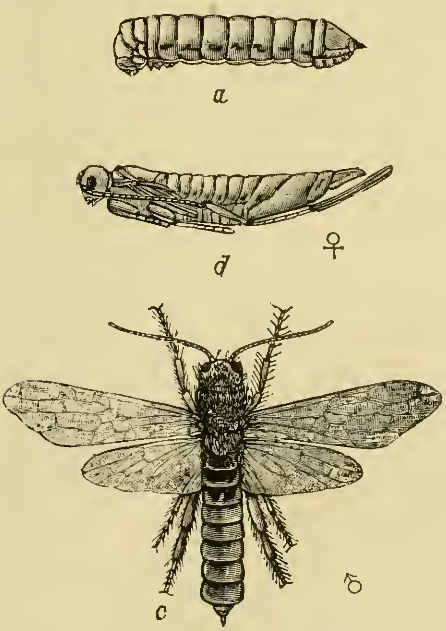

FIG. 37.—*Sirex imperialis* *a*, larva; *d*, pupa, ♀; *c*, imago, ♂. (N.-W. Himalayas.)

Until recently our Indian *Siricidæ* were little known. The life-history of a magnificent species of Sirex, *Sirex imperialis*, not unlike the well-known and oft-quoted *Sirex gigas* of Europe, has been recently partially worked out by the writer and will be described shortly here.*

Sirex imperialis is a large handsome insect, the general colouring of the male being a deep metallic blue, green, and rich chestnut, the wings having a coppery sheen on them. The female is a deep metallic green on its upper surface. The grub is stout, thick, canary yellow in colour and about 1½ inches in length. The pupa is unenclosed in any cocoon, being pale yellow in colour. (See fig. 37, *a*, *d*, *c*.)

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* For a fuller account see 'Departmental Notes on Insects that affect Forestry', No. 2, p. 151, and plate VII.

The female lays her eggs in the wood of dead spruce (*Picea morinda*, Link.) in the North-West Himalayas, drilling holes into the tree by means of the auger and drilling apparatus at the end of her body. The larvæ on hatching out bore winding galleries in the wood (see fig. 38), these galleries having no apparent definite direction. The grubs evidently spend more than a year thus boring in wood, larvæ of various sizes being obtainable at any time. The tunnels made are tightly packed with the wood sawdust passed through the body of the boring larvæ. When full fed the grubs change to pupæ at the end of their tunnels with no special preparation, and the pupa is thus found lying naked at the end of the boring, occupying the only free space unblocked with wood refuse in the gallery. The larvæ pupate about June, and fully developed adults emerge in July. When ready to leave the tree the mature sirex bores its way out by a circular boring, an eighth of an inch in diameter, drilled in the wood by means of its powerful mandibles, and it invariably chooses the shortest route to the outside, the gallery having, however, usually a slight upward direction.* July is given as the month during which the Insect has been observed to issue at elevations of between 6,000 and 7,000 ft. in the North-West Himalayas. It is, however, an undoubted fact that on occasions the Insect

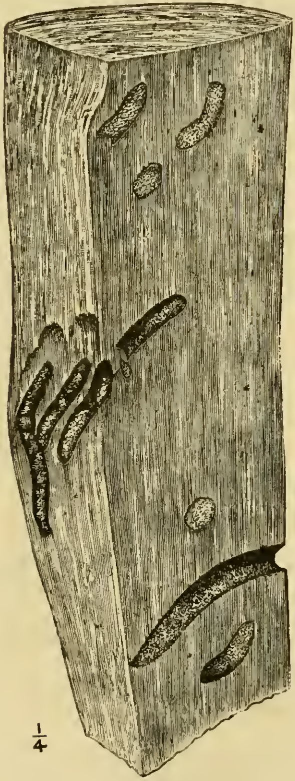

FIG. 38.—Block of Spruce wood showing galleries made by larvæ of *Sirex imperialis*. (N.-W. Himalayas.)

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* *Vide* a note on the habits of the larvæ and adults of *Sirex* and *Thalessa* by the Author in *Nature* of August 21st, 1902.

issues during other months from wood which has been transported to other elevations, the time passed in the larval and pupal stages being considerably lessened in hotter temperatures.

This sirex is capable of doing the most serious injury to timber, as the winding galleries of the larva and the exit holes of the mature Insect riddle the wood and make it useless for anything save fire-wood. Fig. 38 shows a piece of wood from a large spruce tree containing numerous galleries made by the larvæ. Further study of the habits of this Insect may show that it attacks other coniferous trees.

Two other as yet undescribed species of this genus have also been recently found boring into spruce in a manner very similar to that pertainable to the sirex.

Fam. III. Tenthredinidæ—Saw-Flies.

This is an important family, but little is known about its members in India and practically nothing about their habits. The perfect insects have at times a superficial resemblance to a large blue bottle fly, but can be distinguished by having the four wings instead of two; there are no spurs on the front tibiæ of the legs. The larvæ are very like caterpillars (*cf.* fig. 39), having three pairs of thoracic legs and six to eight pairs of abdominal ones; in this they differ from lepidopterous caterpillars, which never have more than five pairs of abdominal legs. Saw-fly larvæ feed exposed on the leaves of plants in the same way as caterpillars, or they may live in galls, etc. The eggs are laid in the bark of the twigs of the food plant and may result in large wounds on these latter.

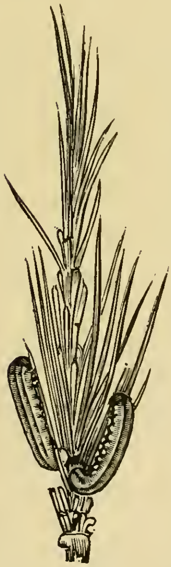

Fig. 39.—Saw-fly larva feeding upon deodar needles (N.W. Himalayas.)

I have said that the life-histories of these Insects have been very little studied in India, but one or two crop-feeding forms being known. Within the last two years, however, three species, as yet undetermined, have been found feeding upon coniferous trees in the North-West Himalayan forests. Of these one infests the deodar, a second the spruce, and the third the silver fir. Observations made on their habits show that they all feed upon the spring crop of needles of these trees, pupating some time in July. The larvæ are bright-green in colour and about an inch or a little over in length. When feeding they take up a very characteristic position, which greatly aids in their recognition, for they coil the lower end of the body round the leaf upon which they are feeding. When full grown they change to pupæ within small light-brown elliptical cocoons, the covering of which is of parchment-like consistency, which they attach to a needle. In the case of the silver fir saw-fly the larva pupates at the beginning of July, the mature fly issuing about the middle of the month. These coniferous saw-flies require careful study, as it is probable that they will play a not unimportant rôle in the forests as their management becomes more intense.

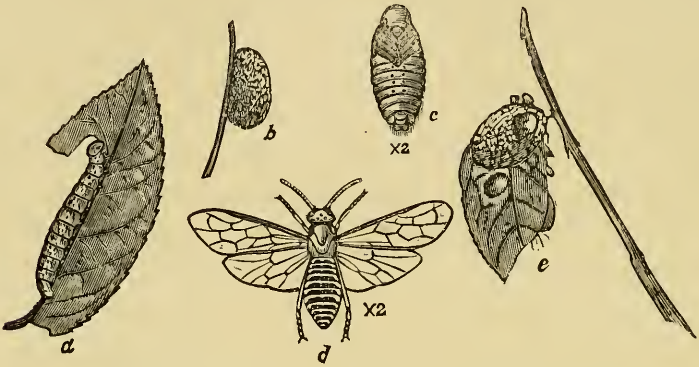

FIG. 40.—Dehra rose leaf Saw-fly, *a*, larva on a rose leaf; *b*, cocoon attached to stem ; *c*, pupa ; *d*, imago ; *e*, leaf with empty cocoons from which flies have issued. (Dehra Dun.)

Almost every year a plague of green saw-flies make their appearance in the autumn on rose bushes in Dehra Dun gardens and entirely strip many bushes of their leaves. This year (1904) it was possible to obtain the flies in thousands from the innumerable larvæ upon the rose trees. The caterpillars spend about two weeks in this stage and 4—6 days as pupæ. The pupa is enclosed in a cocoon attached to the leaf. The flies on issuing apparently pair and lay eggs almost immediately. Fig. 40 shows the larva, cocoon, pupa and fly of this pest.

II.—Hymenoptera Petiolata.

The hind body is connected with the thorax by means of a deep constriction, so that there appears to be a stalk between it and the thorax. This stalk may be long or short, but is always present. This sub-order is divided into three series—

1. PARASITICA or TEREBRANTIA, including the families *Cynipidæ*, *Chalcididæ*, *Ichneumonidæ*, and *Braconidæ*.
2. TUBULIFERA—comprising the *Chrysididæ*.
3. ACULEATA—including the families *Apidæ*, *Diploptera*, *Fossoria* and *Formicidæ*.

SERIES 1.—*Parasitica* or *Terebrantia*.

The trochanters (the second joint of the leg) are of two pieces (*cf.* fig. 34), and the female is furnished with an ovipositor at the extremity of her body.

Fam. IV. Cynipidæ—Gall-flies.

Small, frequently minute, Insects, usually black or pitchy in colour, in which the abdomen is short and compressed, with an ovipositor arising from the ventral surface. The mesonotum is often very convex and has behind a prominent scutellum which projects so as to overhang the metanotum and the median segment which are perpendicular. The sculpture of these parts is often deep and very remarkable. The wings have only a few cells in them and have no stigma (a black patch) on the anterior margins of the upper wings. The antennæ are of importance in identifying a cynipid. They are straight, simple, and are composed of a few (12—15) joints. The larvæ live either in galls, on plants or parasitically in the bodies of other insects, either singly or several together. The female bores into the living portions of plants (stems, leaves, buds) by means of the spine at the end of the abdomen, and deposits an egg in the hole thus made; later on, the plant tissue swells up in different ways owing to the irritation set up by the larva feeding upon the tissues. The different forms of gall thus arising are characteristic of different species of insect. In many species a regular alternation of a parthenogenetic and a true sexual generation exists, the two generations being dissimilar and causing galls of very different appearance.

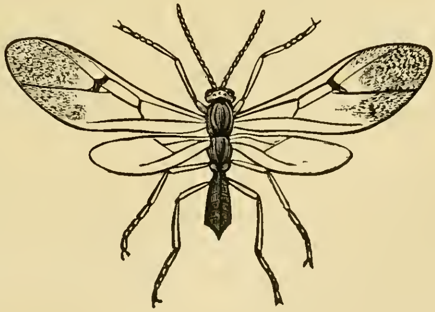

FIG. 41.—A gall-fly.

Little is known about the life-histories of gall-flies in India, and the study of this interesting family greatly needs some energetic workers. Fig. 41 shows a gall-fly imago.

Fam. V. Proctotrypidæ.

Small Insects with only a few or at times no nervures in the wings: the prothorax is closely adherent to the mesothorax, reaching backwards at the sides to the points where the wings are attached. There is often a black spot (stigma) on the front wing which distinguishes them from Cynipidæ. The abdomen is pointed, and the pointed apex is often deflexed downwards; the ovipositor is not coiled but is retractile, and when extended is tubular in form and apparently a continuation of the tip of the body. This tubular ovipositor forms the chief distinguishing feature of the family from other parasitic Hymenoptera.

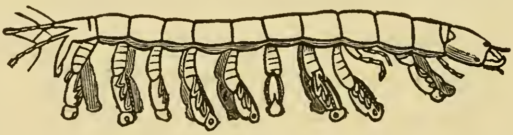

FIG. 42.—Pupation of *Proctotrypes* sp. in body of a beetle larva (after Sharp).

The larvæ, as far as our present knowledge of these Insects goes, live a completely parasitic life in the bodies or eggs of other insects or of spiders, one or several being present in a single egg or insect's body. They usually pupate in the position in which they have fed, enclosed each one in a more or less distinct cocoon. In fig. 42 Dr. Sharp* has shown a remarkable case of this pupation; "a larva of some beetle has had a number of eggs laid in it by a species of *Proctotrypes.* The grubs hatching out from the eggs have fed upon the beetle larva and then pupated; the pupæ are shown projecting from the body of the host, a pair of the parasites issuing from each segmental division in a remarkably symmetrical manner."

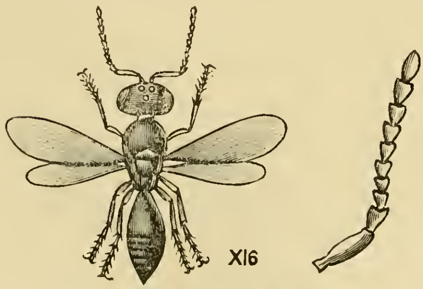

FIG. 43.—*Platygaster oryzæ* which is parasitic on the rice-fly pest. Antenna, enlarged, is shown to right. (Bengal.)

Little is known about this family in India. Fig. 43 shows the minute Proctotrypid known as *Platygaster oryzæ,* Cameron, which is parasitic on the rice-fly pest (*Cecidomyia oryzæ*, W. Mason) which causes considerable damage in the rice fields. This latter pest will be considered under the Order Diptera. The Proctotrypid probably lays its eggs in the Cecidomyid larvæ and the grubs on hatching out feed upon the former. The parasite was bred out from the rice pest by Mr. Wood Mason when Superintendent of the Indian Museum. Fig. 43 shows the parasitic fly much enlarged, and to the right the enlarged antenna to show its structure. It will not improbably be found that this family is of the greatest economic use to the agriculturist in India in keeping down the members of many of the more minute pests attacking crops. As such its study, whilst affording a rich field for new discoveries, will well repay him who takes it up.

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* In the Cambridge Natural History, Insects, Part I (Vol. V).

Fam. VI. Chalcididæ—Chalcid-Flies.

The prothorax is capable of some movement, its angles do not extend backwards to meet insertion of wings. The antennæ are elbowed, consisting of from seven to thirteen joints. The wings have no system of cells in them; there is a single well-marked nervure running from the base near the front margin (costa), afterwards it passes to the costa and gives off a very short vein more or less thickened at its termination. The insects are frequently of brilliant colours and remarkable form.

The species known number over 4,000, and of these 3,000 are European. There is little reason to believe that the family is not equally well represented in the tropics, the insects, owing to their minute size, not having yet been worked at or collected. Observations have already shown the writer that the family appears to be very well represented in India, where it probably, economically, does a vast amount of good.

The larvæ may live in galls, feeding on the larvæ of the makers of the galls; others attack caterpillars, others pupæ only; some flourish at the expense of bees or other Hymenoptera or of Coccidæ and Aphidæ (Hemiptera), and some deposit their eggs in the egg-cases of Blattidæ (cockroaches), whilst others prey upon parasitic and useful Tachnid flies. A little is known about some thirty or forty Indian species.

Cotesia flavipes, shown in fig. 44, is a tiny fly which lays its eggs in the caterpillars of the destructive sugarcane, borer *Chilo simplex* (a moth which will be treated of later) and serves to keep the numbers of this destructive pest in check, since the chalcid grubs feed upon and kill off the caterpillars. In a similar manner *Chalcis euplœa* shown in fig. 45, very effectively keeps down the numbers of some very important tea and sál tree defoliating caterpillars (*Lymantria* and *Dasychira*) in the Bengal Duars and Assam. At times these caterpillars get the upper hand and swarm in incredible numbers, clearing every leaf from the bushes and trees. This leads after a few weeks to a similar increase in the numbers of the chalcid, which finally succeeds in bringing down to due proportions the numbers of the moth caterpillars. The family Coccidæ or scale Insects (Order Hemiptera) contains many serious pests both to crops and planters. Observation has shown that many of these are parasitised by chalcid flies. The eggs are laid as usual by the female chalcid in the body of the scale Insect, and the grubs on hatching out feed upon and destroy the scale. Amongst chalcids which are known to be of use in this way may be mentioned *Aphelinus theæ* (shown in fig. 46) parasitic on the tea scale bug (*Chionaspis theæ*), *Cirrhospilus coccivorus*, *Encyrtus nietneri*, *E. paradisicus*, *Scutellista*

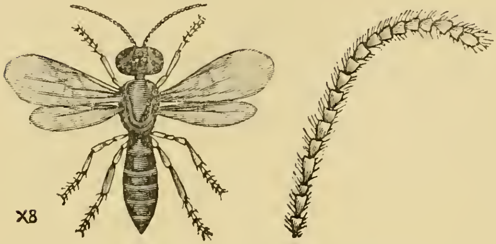

FIG. 44.—*Cotesia flavipes*, which is parasitic upon the well-known destructive sugarcane borer *Chilo simplex*. (Bengal.) Antenna enlarged on the right.

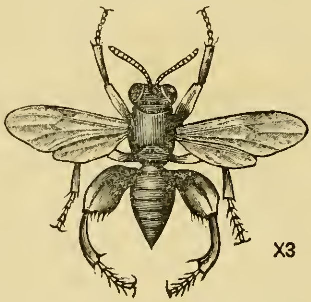

FIG. 45.—*Chalcis euplœa* parasitic upon tea and *sál* leaf defoliating caterpillars. (Bengal Duars.)

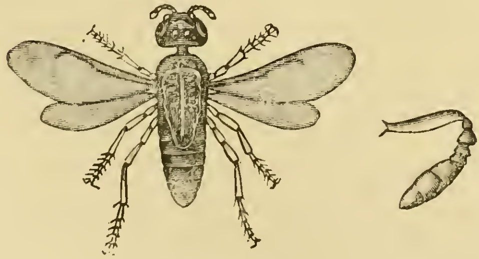

FIG. 46.—*Aphelinus theæ*, which is parasitic upon the tea scale bug. True size of insect is slightly less than ·5 millim. (India.)

cyanea, *Marietta leopardina*, *Cephaleta purpureiventris*, *C. brunneiventris* and *C. fusciventris* parasitic on the brown bug (*Lecanium coffeæ*) of coffee and *Encyrtus nietneri* and *Chartocerus musciformis* parasitic on the white bug (*Pseudococcus adonidum*) of coffee. This list of parasitic chalcids shows that the family, although the individuals are so minute, contain species of extreme importance to man, and agriculturists and planters would do well to remember that minute flies hovering about during severe infestations of defoliating caterpillars or serious scale insect attacks are probably there as friends and not enemies. Another chalcid is parasitic upon the so-called cheroot-weevil (*Lasioderma testaceum*), and cigar merchants in India should learn to distinguish between this minute friend when flying about in the godown and the beetle which is the real author of the damage. The chalcid is of course beneficial.* As yet undetermined species of the family have been found parasitic upon the larvæ of *Polygraphus, Pityogenes* and *Scolytus* bark-boring beetles in blue pine and deodar trees in the North-West Himalayas.

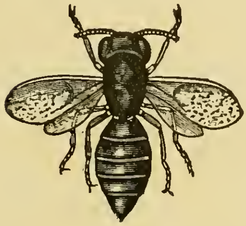

FIG. 47.—Chalcid parasitic on the cheroot-weevil). Calcutta.)

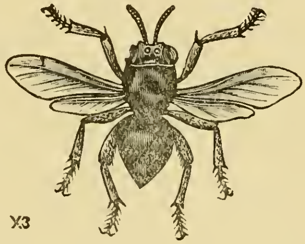

FIG. 48.—*Perilampus* sp., parasitic upon useful tachnid flies (Bengal Duars) $\frac{8}{1}$.,

Mention has been made of the fact that some chalcids prey upon useful parasitic Insects such as the great family of Tachnid two-winged flies (Order Diptera). A species of Perilampus, *Perilampus* sp. (fig. 48) is thought to be parasitic in this way upon one or both of the flies *Trycolyga bombycis* and *Masicera dasychiræ* which are parasitic upon the caterpillars of the moth of a species of *Dasychira*. The larvæ of this latter Insect commit serious defoliation in tea gardens and in sál forests in the Bengal Duars and in Assam. This is an instance of a chalcid which is a foe and not a friend to man, since its grubs live in and feed upon the larvæ of a beneficial Insect.

**Vide* Circular on Agri. Econ. Ent. No. 12, the Cheroot-Weevil. Issued by Trustees, Indian Museum, Calcutta, 1903.

Fam. VII. Ichneumonidæ—Ichneumon Flies.

The Ichneumons are Insects with a long slender body and many-jointed antennæ. The wings have a well-developed series of nervures and cells in them; the space on the front wing separating the second posterior cell from the cubital cells is divided into two cells by a transverse veinlet. The abdomen is attached to the lower or posterior part of the median segment. The female has usually a long protruding ovipositor. (See fig. 49.) These Insects are parasitic in their larval stages. The egg is deposited by the mother in or on or near the body of the grub. The larva on hatching out is a little white legless maggot which feeds upon the fatty tissues of its host, the latter eventually dying of exhaustion, although it may have sufficient strength to turn into a pupa first. When full fed the ichneumon grub spins itself up into a cocoon. This it may do inside the now dying or dead host larva, or it may attach the cocoon to the outside of the skin, or it may lie free outside the latter. It often happens that two or more eggs are laid upon the caterpillar by the ichneumon fly and then several cocoons are obtained from the dead caterpillar or from the pupa into which it has changed. Owing to the peculiar methods of existence of its members it will be obvious that this family performs a very important service to man by keeping down defoliating larvæ and stem and wood-boring pests and, in fact, Insect pests of all kinds. At the same time it is also injurious to some extent owing to the fact that it also lays its eggs and kills off useful predaceous and parasitic Insects. From the little we already know of the life histories of some of our Indian Ichneumonidæ it has become evident that the family is of the very first economic importance in this country, and its study, therefore, for this reason alone, is strongly advocated.

The members of the genera Rhyssa and Thalessa are among the most remarkable of the ichneumon flies. These Insects have ovipositors of two to four inches in length (fig. 49) and are parasitic upon species of the family Siricidæ which, as above described, live in solid wood. The following is a note on a portion of the life history* of a new and undescribed species of Rhyssa, *Rhyssa* sp. † which is parasitic

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* *Vide* foot-note on p. 119.

† Col. C. T. Bingham hopes to shortly describe this species for me.

upon *Sirex imperialis* already mentioned as infesting spruce in the North-West Himalayas. The adult Insect appears on the wing about the beginning of June. The female is a fairly large handsome fly, black in colour with yellow spots upon the thorax and a pink spot on either side of each segment of the body. It is one inch in length with an ovipositor of one and a half inches (fig. 49). Dead mature Insects have been found in some numbers in spruce riddled by *Sirex imperialis*, the tunnels in which the ichneumons were found communicating with the Sirex ones in such a manner as to leave no doubt that the former was parasitic upon the latter. The larval and pupal stages of the ichneumons have not yet been found. There can be little doubt that this parasite is of the greatest service in keeping down the numbers of the borer. It appears to itself suffer when the wood-wasp larva has gone very deep into the wood, as the ichneumon fly on becoming mature has then apparently not sufficient strength to bore its way out of the tree and dies in the wood after having gone a certain distance.*

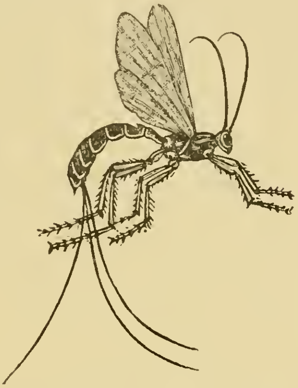

FIG. 49.—Rhyssa sp. parasitic upon the larvæ of *Sirex imperialis* (N.-W. Himalayas) $\frac{1}{1}$.

Pimpla punctator, Linn., is an ichneumon common in parts of Bengal and Assam. It is a well-known parasite of the silk-worm moth *Antheræa roylei*, Moore, and has also been reared in the Indian museum from several species of *Saturniidæ*, a family of moths whose caterpillars are serious defoliators. The male and female are shown in fig. 50. The wheat and rice weevil is parasitised by the tiny coppery-green

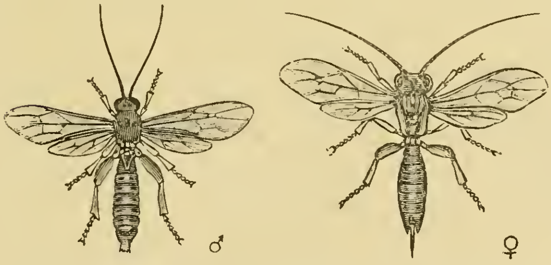

FIG. 50.—*Pimpla punctator*, ♂ and ♀, parasitic upon species of *Saturniidæ*. (Reared in Indian museum, Calcutta.) $\frac{1}{1}$.

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* For a fuller account, *vide* Departmental Notes on Insects that affect Forestry No. 2, p. 155, and plate VII, Fig. 2.

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ichneumon fly shown in fig. 51. The fly lays its eggs on or in the grubs of the weevil as they lie feeding inside the grain. The ichneumon grub, on hatching out, feeds upon the weevil grub, but in such a manner as not to kill it until both have reached their full size. The weevil grub then dies, the fly grub changes to a pupa, from which issues the small copper-coloured ichneumon fly. This latter pairs, and the female then flies about over grain heaps searching for a grain containing a weevil grub in which, when found, she lays an egg.

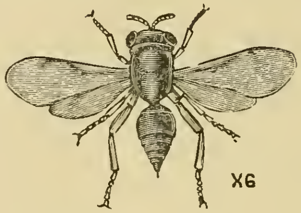

FIG. 51.—*Petromalus oryzæ* parasitic upon the wheat and rice weevil (Calcutta) × 6.

Fam. VIII.—Braconidæ—Bracon-flies.

These Insects are very similar to the ichneumons. The antennæ consist of many, nearly always more than 15, joints, and the wings have a moderate number of cells in them. They can be distinguished from the ichneumons by the fact that the hind body has a much less degree of mobility of its segments, and the upper wings differ, the series of cells running *across* the wing being only three in the ichneumonides whereas they are four in the braconides, and a centre cell behind 2 and 3 is divided transversely into two in the former, but is undivided in the latter (fig. 52). If these distinguishing characters are remembered, the two families can always be

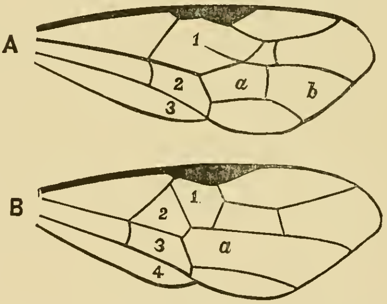

FIG. 52.—Diagram of wing of Ichneumon (A) and of Braconid (B). 1, 2, 3, 4 series of cells extending across the wing; *a*, *b*, divided cell of the Ichneumon wing corresponding with, a, the undivided cell of the Braconid wing. (After Sharp.)

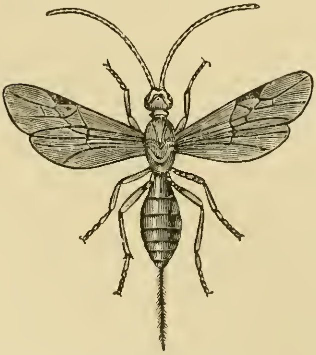

FIG. 53.—A Braconid fly.

distinguished from one another. Fig. 53 shows a braconid fly. The habits of this family are similar to the last, it being believed that its members are nearly all parasites. Usually they attack the larvæ, but they are bred in great numbers from pupæ and occasionally from imagoes of other Insects. The family requires careful study in India where its members are undoubtedly of the greatest service to man both in the field, plantation and forest. The writer has recently bred out Bracon flies from two Scolytid barkboring pests—*Scolytus major* and *S. minor* (Order Coleoptera)—which infest deodar trees in the North West Himalayas. The flies lay their eggs in or on the scolytus grubs and the Bracon larvæ feed upon the latter.

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THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES III. PART II.

By Sir G. F. Hampson, Bart., F.Z.S., F.E.S.

(*With Plate D.*)

(*Continued from page* 653, *Vol. XV.*)

Genus Sphingnæopiopsis.

	Type.
Sphingonæpiopsis, Wllgrn. Œfv. Vet. Ak. Förh. XV. p. 138. (1858)	*nanum.*

176. Sphingonæpiopsis pumilio.

Lophura pumilio, Boisd. Spec. Gén. Lép. Hét., I. p. 311 (1875).

,, *pusilla*, Butl. P. Z. S., 1875, p. 244.

,, *minima*, Butl., P. Z. S., 1876, p. 310, pl. 22, f. 4.

Habitat.—Assam ; Khasis ; Penang ; Malacca.

Genus Eurypteryx.

	Type.
Eurypteryx, Feld. Reis. Nov. p. 5 (1874). non descr. ; Boisd. Spec. Gén. Lép. Hét., I. p. 46 (1875)	*molucca.*

151. Eurypteryx bhaga.

Darapsa bhaga, Moore, P. Z. S., 1865, p. 794.

Habitat.—Sikhim ; Bhutan ; Assam ; Nias.

Subsp. *obtruncata*, Roths. Nov. Zool. IX., Suppl., p. 595 (1903).

Habitat.—Celebes.

Genus Rhodosoma.

	Type.
Rhodosoma, Butl. Trans. Zool. Soc., IX. p. 534 (1877)	*triopus.*

208. Rhodosoma triopus.

Macroglossa triopus, Westw. Cab. Or. Ent., p. 14, pl., 6, f. 4 (1848).

Habitat.—Sikhim ; Bhutan ; Assam.

Genus Macroglossum.

	Type.
Macroglosssum, Scop. Intr. Hist. Nat., p. 414 (1777)	*stellatarum.*
Psithyros, Hübn. Verz., p. 131 (1827)	*stellatarum.*
Rhamphoschisma, Wllgrn. Œfv. Vet. Ak. Förh. XV. p. 139 (1858)	*trochilus.*
Bombylia, Hübn. Tent. Ined.	*stellatarum.*

A. Hindwing on underside with the base white or yellowish-white .... *bombylans.*

B. Hindwing on underside with the base reddish or yellow or with yellow patch on inner area.

a. Hindwing with the costa dilated into an antemedial lobe.. ..... *aquila.*

b. Hindwing with the costa normal.

a^1. Forewing with band from middle of costa to tornus. *hemichroma.*

b^1. Forewing without band from middle of costa to tornus.

a^2. Head and thorax with two broad grey stripes on the olive-black ground colour .... *mitchelli.*

b . Head and thorax without two broad grey stripes.

a^3. Forewing the basal area black or greenish black sharply defined by the straight antemedial band.

a^4. Abdomen brown below............................. *faro.*

b^4. Abdomen tawny below......... .... *passalus.*

b^3. Forewing with the basal area much paler than the antemedial band.

a^4. Hindwing with very narrow tawny brown border ... . *stellatarum.*

b^4. Hindwing with more or less broad tawny or black border or almost entirely black.

a^5. Hindwing tawny without yellow band or with a yellow band defined on outer side towards costa.

a^6. Hindwing tawny.

a^7. Forewing with the antemedial band filled in with black .... *regulus.*

b^7. Forewing with the antemedial band not filled in with black .... *gyrans.*

b^6. Hindwing with tawny yellow band.

a^7. Forewing with sharply defined grey medial costa area; antemedial band very oblique .... *particolor.*

b^7. Forewing without grey medial costal area.

a^8. Abdomen with the lateral yellow patches separate.

a^9. Forewing with the brown postmedial spot very prominent... *assimilis.*

b^9. Forewing with the brown postmedial spot not prominent ... *belis.*

b^8. Abdomen with the yellow lateral patches confluent.................... *affictitia.*

b^{5}. Hindwing with sharply defined brownish black terminal band often dilated at middle, or with the yellow band obsolescent.

a^{6}. Forewing on upperside with the postmedial lines not prominent, no grey subapical patch on costa or streak on vein 6, or brown subapical spot, or brown dorsal spots on abdomen.

a^{7}. Abdomen blackish brown ventrally. *sylvia.*

b^{7}. Abdomen greyish yellow or tawny ventrally .... *corythus.*

b^{6}. Forewing or abdomen with all or some of these markings dintinct.

a^{7}. Forewing with apical patch on costa; vein 6 not grey before the black subapical spot .... *saga.*

b^{7}. Forewing without grey subapical patch, or vein 6 streaked with grey before the black subapical spot.

a^{8}. Forewing with the antemedial band filled in with black on outer half; underside of wings blackish brown *semifasciata.*

b^{8}. Forewing with the antemedial band not filled in with black on outer half; postmedial lines distinct; underside of wings tawny.. *inspida pœcilum.*

c^{8}. Forewing with the antemedial band not filled in with black or entirely black.

a^{9}. Forewing with the antemedial band and postmedial lines more or less confluent .... *glaucoptera.*

b^{9}. Forewing with the antemedial band and postmedial lines separated by a greyish area.

a^{10}. Forewing with vein 6 streaked with grey; hindwing with the yellow band not incurved... *prometheus.*

b^{10}. Forewing without grey streak on vein 6 or hindwing with the yellow band incurved.

a^{11}. Forewing with grey streak on vein 6; palpus dirty cinnamon grey.. *variegatum.*

b^{11}. Forewing without grey streak on vein 6 or palpus greyish white.

a^{12}. Forewing with the antemedial band filled in with black, its outer edge straight; medial area grey, band-like; 2nd postmedial line dilated below vein 6; palpus greyish white ; abdomen olive brown above.. *fringilla.*

b^{12}. Forewing as in *heliophila,* but the 1st postmedial line as strong as 2nd line............ *divergens.*

c^{12}. Forewing with the antemedial band not filled in with black.

a^{13}. Forewing and abdomen on underside bright tawny, or the latter black with tawny spots.

a^{14}. Size small; ♂ with the harpe not divided. *insipida.*

b^{14}. Size small ; ♂ with the harpe divided ... *troglodytus.*

c^{14}. Size large ; medial area of forewing wide. ♂ with the harpe divided.................. *pyrrhosticta.*

$b.^{13}$ Forewing and abdomen on underside less tawny and more cinnamon. .... *sitiene.*

183. MACROGLOSSUM STELLATARUM.

Sphinx stellatarum, Linn, Syst. Nat., X. p. 803 (1758).

„ *flavida,* Retz., Gén Ins., p. 33 (1783).

Macroglossa nigra, Cosm., Le Nat., XIV., p. 280 (1892).

Habitat.—EUROPE ; N. AFRICA ; W. & C. ASIA ; JAPAN ; CHINA ; SIND ; PUNJAB ; COCHIN CHINA.

191. MACROGLOSSUM BOMBYLANS.

Macroglossa bombylans, Boisd., Spec. Gén. Lép. Hét., I, p. 334 (1875).

„ *walkeri,* Butl., P. Z. S., 1876, p. 4.

Habitat.—JAPAN ; CHINA ; PUNJAB ; SIKKIM ; BHUTAN ; ASSAM.

179. MACROGLOSSUM REGULUS.

Macroglossa regulus, Boisd., Spec. Gén. Lép. Het., I., p. 335 (1875).

„ *fervens,* Butl., P. Z. S., 1875, p. 4, pl. 1, f. 3.

Habitat.—BOMBAY ; CANARA ; NILGIRIS ; CEYLON.

181. MACROGLOSSUM GYRANS.

Macroglossa gyrans, Wlk., VIII., 91 (1856).

„ *zena,* Boisd., Spec. Gén. Lép. Hét. I. p. 337 (1875).

„ *bombus,* Mab., Ann., Soc. Ent. Fr. 1880, p. 347.

„ *burmanica,* Roths., Nov. Zool., I., p. 58, pl. 5, f. 3 (1894).

Habitat.—PUNJAB ; BOMBAY ; MADRAS ; NILGIRIS ; CEYLON ; BURMA ; BORNEO ; JAVA ; FLORES ; SUMBA ; LETTI ; KISSER

182. MACROGLOSSUM AFFICTITIA.

Macroglossa affictitia, Butl., P. Z. S., 1875, p. 240, pl. 36, f. 7.

„ *vialis,* Butl., P. Z. S., 1875, p. 240, pl. 36, f. 5.

Habitat.—MADRAS ; NILGIRIS ; CEYLON.

182*a*. MACROGLOSSUM PARTICOLOR.

Macroglossum particolor, Roths., Nov. Zool., IX., Suppl., p. 636, pl. iv, f. 13 1903).

Habitat.—MAHE ; MADRAS.

184. Macroglossum belis.

Sphinx belis., Linn, Syst. Nat., X., p. 493 (1758).
Macroglossa pyrrhula, Boisd., Spec. Gén. Lèp. Hét., I., p. 338 (1875).
„ *opis*, Boisd., Spec., Gén , Lép. Hét. I., p. 345 (1875).

Habitat.—Loo Choo Is.; China ; Punjab ; Sikhim ; Bhutan ; Assam ; Madras ; Ceylon ; Tonkin.

195. Macroglossum assimilis.

Macroglossum assimilis, Swains., Zool. Illust., pl. 64 (1821).
Macroglossa gilia, Herr., Schäff. Ausser. Eur. Schmett, f. 107 (1854).
„ *bengalensis*, Boisd., Spec. Gén. Lép. Het., I. p. 341 (1875).
„ *taxicolor*, Moore, P. Z. S., 1879, p. 387.
„ *belia*, Hmpns., Ill. Het. B. M., IX., p. 58, pl. 157, f 15 (1893).

Habitat.—Madras ; Nilgiris ; Ceylon ; Java.

195*a*. Macroglossum pyrrhosticta.

Macroglossa pyrrhosticta, Butl. P. Z. S., 1875, p. 242, pl. 38, f. 8.
„ *catapyrrha*, Butl., P. Z. S., 1875, p. 243, pl. 36, f. 6.

Habitat.—Japan ; Loo Choo Is. ; China ; Sikhim ; Bhutan ; Annam ; Tonkin ; Philippines ; Lombok.

195*b*. Macroglossum troglodytus.

Macroglossa troglodytus, Boisd., Spec. Gén. Lép. Het., I, p. 344 (1875).

Habitat.—China ; N. and S. India ; Ceylon ; Java.

194. Macroglossum insipida.

Macroglossa insipida, Butl., P. Z. S., 1875, p. 242.
„ *limata*, Swinh., Cat. Het. Mus. Oxon, I., p. 4, pl. 1, f. 1 (1892).

Habitat.—N. and S. India ; Ceylon ; Andamans ; Penang ; Borneo ; Java.

Subsp. *papuanum*, Roths., Nov. Zool., IX., Suppl., p. 642, pl. iii., f. 9 (1903).

Habitat.— Ferguson I. ; d'Entrecasteaux Is.; Sudest ; St. Aignan ; Queensland.

Subsp. *pœcilum*, Roths., Nov Zool., IX., Suppl., p. 643, pl. iii., f. 17 (1903).

Habitat.—Loo Choo Is.

189. Macroglossum sitiene.

Macroglossa sitiene, Wlk., VIII,. 92 (1856).
„ *sinica*, Boisd., Spec. Gén Lép Hét., I., p. 340 (1875).
„ *nigrifasciata*, Butl.,:P. Z. S., 1875, p. 24, pl. 37, f. 3.
„ *orientalis*, Butl., Trans. Zool. Soc., IX., p. 528 (1877).

Habitat.—Nilgiris ; Ceylon ; Philippines.

189*a*. Macroglossum fringilla.

Macroglossa fringilla, Boisd., Spec. Gén. Lép. Hét., I., p. 352 (1875).
„ *heliophila*, Boisd. Spec. Gén. Lép. Hét, I., p. 354, pl. II, f. 2 (1875)
„ *kanita*, Swinh., Cat. Het. Mus. Oxon., I., p. 5, pl. 1, f. 2 (1892)
„ *loochooana*, Roths., Nov. Zool., I., p. 67 (1894),

Habitat.—Loo Choo Is. ; Honkong ; Formosa ; Tonkin ; Nilgiris ; Borneo ; Philippines ; Java.

196. Macroglossum divergens.

Macroglossa divergens, Wlk., VIII., 94 (1856).

Habitat.—Ceylon.

196*a*. Macroglossum prometheus.

Macroglossum arcuatum, Moore, Lèp. E. I. C., p. 262 (1857), non descr.

Macroglossa prometheus, Boisd., Spec. Gén. Lép. Het., I., p. 355 (1875).

Habitat.—Ceylon; Penang; Malacca; Borneo; Philippines; Nias; Java.

Subsp. *inusitata*, Swinh. Cat. Het. Mus. Oxon., I., p. 6 (1892).

Macroglossa inconspicua, Roths., Nov. Zool., I., p. 68 (1894).

Habitat.—New Guinea: Rossell. I.; St. Aignan; Fergusson and Trobriand Is; Queensland.

196*b*. Macroglossum variegatum.

Macroglossum variegatum, Roths., Nov. Zool., IX., Suppl., p. 653 (1903).

Habitat.—Sikkim; Assam; Sumatra; Borneo.

184*a*. Macroglossum saga.

Macroglossa saga, Butl., Ent. Mo. Mag., XIV., p. 206 (1878).
,, *kiushiuensis*, Roths., Nov. Zool., I., p. 66 (1894).
,, *glaucoplaga*, Hmpsn., J. Bomb. N. H. Soc., XIII., p. 40, pl. *B*, f. 13 (1900).

Habitat.—Japan; Sikhim.

190. Macroglossum glaucoptera.

Macroglossa glaucoptera, Butl., P. Z. S., 1875, p. 241, pl. 36, f. 9.
,, *obscuripes*, Butl., P. Z. S., 1876, p. 309, pl. 22, f. 5.
,, *lepscha*, Butl., Trans. Zool. Soc., IX., p. 635 (1877).
,, *fuscata*, Huwe, Berl. Ent. Zeit., XL., p. 358, pl. 3, f. 5 (1895).

Habitat.—Bengal, Calcutta; Ceylon; Penang; Malacca; Java.

187. Macroglossum semifasciata.

Macroglossa semifasciata, Hmpsn., Moths. Ind., I., p. 115 (1892).

Habitat.—Burma; Labuan, Borneo; Java.

201. Macroglossum aquila.

Macroglossa aquila, Boisd., Spec. Gén Lép Hét., I., p. 340 (1875).
,, *interrupta*, Butl., P. Z. S., 1875, p. 242, pl. 37, f. 2.

Habitat.—Sikhim; Assam; Cochin China; Malacca; Borneo; Philippines.

186*a*. Macroglossum sylvia.

Macroglossa sylvia, Boisd. Spec. Gén. Lép. Hét., 1, p. 350 (1875).
,, *obscura*, Butl. P. Z. S., 1875, p. 5, pl. 1, f. 2.

Habitat.—Formosa; Assam; Ceylon; Perak; Java; Celebes.

186. Macroglossum corythus.

Macroglossa corythus, Wlk., VIII., 92 (1856).
,, *proxima*, Butl. P. Z. S., 1875, p. 4, pl. 1, f. 1 (1875).

Habitat.—S. India; Ceylon.

Subsp. 1, *platyxanthum*, Roths., Nov. Zool., IX., Suppl., p. 660, pl. iv, f. 1 (1903).

Habitat.—Loo Choo Is.

Subsp. 2, *luteata*, Butl., P. Z. S., 1875, p. 241, pl. 37, f. 5.

Habitat.—CHINA ; FORMOSA ; SIKHIM ; BHUTAN ; ASSAM ; BURMA ; TONKIN ; PENANG ; PERAK ; ANDAMANS ; BORNEO ; PHILIPPINES ; JAVA ; FLORES ; SUMBA ; CELEBES.

Subsp. 3, *pylene*, Feld., Sitz. Ber. Ak. Wiss. Wien., XLIII., p. 29 (1861).

Macroglossa phlegeton, Boisd. Spec. Gén. Lép. Hét., I., p. 346 (1875).
„ *motacilla*, Boisd. Spec. Gén. Lép. Hét., I., p. 347 (1875).
„ *cyniris*, Boisd. Spec. Gén. Lép. Hét, I., p. 350 (1875).
„ *approximans*, Lucas, The Queenslander, XXXIX., p. 834 (1891).
„ *labrosa*, Swinh., Cat. Hét. Mus. Oxon., I., p. 5 (1892).
„ *moluccensis*, Roths. Nov. Zool, I., p. 67 (1894).

Habitat.—MOLUCCAS ; NEW GUINEA and adjacent Islands ; QUEENSLAND.

Subsp. 4, *xanthurus*, Roths., Nov. Zool., IX., Suppl., p. 662 (1903).

Habitat.—TENIMBER Is.

Subsp. 5, *fulvicaudata*, Butl., A., M. N. H. (5), X. p. 155 (1882).

Habitat.—BISMAREK ARCHIPELAGO ; SOLOMON Is.

Subsp. 6, *fuscicauda*, Roths., Nov. Zool., IX., Suppl., p. 663 (1903).

Habitat.—LOYALTY Is.

200. MACROGLOSSUM HEMICHROMA.

Macroglossa hemichroma, Butl., P. Z. S., 1875, p. 243, pl. 37, f. 1.

Habitat.—ASSAM ; BORNEO ; PHILIPPINES ; JAVA.

198. MACROGLOSSUM PASSALUS.

Sphinx passalus, Drury, Illustr. Ex. Ins., II., p. 52, pl. 29, f. 2 (1773).
„ *pandora*, Fabr. Ent. Syst III., p. 380 (1793).

Macroglossa sturnus, Boisd. Spec. Gén. Lép. Hét., I., p. 349 (1875).

Habitat.—LOO CHOO Is. ; CHINA ; FORMOSA ; COCHIN CHINA.

Subsp. *rectifascia*, Feld. Reis. Nov., pl. 75, f. 7 (1874).

Habitat.—S. INDIA ; CEYLON.

199. MACROGLOSSUM FARO.

Sphinx faro, Cram., Pap. Exot., III., p. 165, pl. 385, f. c. (1780).

Habitat.—LOO CHOO IS ; S. INDIA ; PENANG ; PERAK ; BORNEO ; JAVA.

197. MACROGLOSSUM MITCHELLI.

Macroglossa mitchelli, Mén. Enum. Corp. Anim. Petr. Lép., p. 95 (1857).

Habitat.—JAVA.

Subsp. *imperator*, Butl., P. Z. S., 1875, p. 243, pl. 37, f. 4.

Habitat.—ASSAM ; S. INDIA ; CEYLON.

Genus RHOPALOPSYCHE.	*Type.*
Rhopalopsyche, Butl. P. Z. S., 1875, p. 239	*nycteris.*

177. RHOPALOPSYCHE NYCTERIS.

Macroglossa nycteris, Koll., Hügel's Kashmir, IV., 2, p. 458, pl. 19, f. 5 (1844).
„ *volucris*, Wlk., VIII., 94 (1856).

Habitat.—LOO CHOO Is. ; W. CHINA ; PUNJAB ; KASHMIR ; SIKHIM ; BHUTAN ; ASSAM,

178. RHOPALOPSYCHE BIFASCIATA.

Rhopalopsyche bifasciata, Butl., P. Z. S., 1875, p. 239, pl. 36, f. 4.

Habitat.—S. INDIA ; CEYLON.

Subfamily PERGESINÆ.

A. Proboscis with the base exposed ; palpi with the 2nd joint not contiguous.
  a. Palpus with the 2nd joint distinctly narrower than the 1st, more or less tapering apically.................. *Cechenena.*
  b. Palpus with the 2nd joint not narrower than the 1st. *Rhagastis.*
B. Proboscis with the base not exposed ; palpi with the 2nd joint contiguous.
  a. Palpus with the scaling at apex of 1st joint dense and regular on innerside.
    *a*¹. Palpus with apical tuft of scales on innerside of 2nd joint directed downwards and inwards.
    *a*². Palpus with the scaling of 1st joint on outerside longest just below the apical cavity .... *Rhyncholaba.*
    *b*². Palpus with the scaling of 1st joint on outerside longest at base .... *Theretra.*
    *b*¹. Palpus without apical tuft of scales on inner side of 2nd joint .... *Hippotion.*
  b. Palpus with the scaling at apex of 1st joint not dense, and irregular on innerside.
    *a*¹. Palpus rough with long scattered hairs .... *Pergesa.*
    *b*¹. Palpus without or with very few long scattered hairs .... *Celerio.*

Genus CELERIO. *Type.*

Celerio, Oken, Lehrb., Naturg. III., I, p. 761 (1815). .... *gallii.*
Phryxus, Hübn., Verz., p. 137 (1827). .... *lineata.*

A. Pulvillus present.
  a. Forewing with the veins traversing the brown band pale, the pale band sharply defined......... *lineata.*
  b. Forewing with the veins not pale.
    a. Forewing with the costal area on upperside brown and clearly defined .... *gallii.*
    b. Forewing with the costal area pale with a large patch beyond apex of cell, a prominent broad basal band................ *nicœa.*
B. Pulvillus vestigial, represented by a very small process or flap.
  a. Forewing with the costal area on upperside brown and sharply defined, the veins on brown postmedial band not pale, terminal band slightly paler than postmedial band ; underside not rosy red .... *zygophylli.*

b. Forewing if the costal area is all brown with the veins on postmedial band pale, or the terminal band pale, or underside rosy red .... *euphorbiæ.*

154. CELERIO EUPHORBIÆ.

Sphinx euphorbiæ, Linn. Syst. Nat., X., p. 492 (1758).

,, *esulæ,* Hüfn., Berl. Mag. II., p. 180 (1774).

Deilephila paralias, Nickerl , Böhm. Tag., p. 22, f. 2 (1837).

,, *helioscopiæ,* Sely-Longch. Ann. Soc. Ent. Belg., I., p. 40 (1857)

, *grentzenbergi,* Staud. Ent. Nachr., XI., p. 10 (1885).

,, *lafitolei,* Thierry, Mieg. Le Nat., XI., p. 181 (1889).

, *rubrescens,* Garbowski, Sitz. Ber. Ak. Wiss Wien., p. 917 (1892).

,, *defecta,* Calb. Iris, II., p. 88 (1899).

,, *nigrescens,* Roths., Nov. Zool., IX., Suppl., p. 720 (1903).

,, *restricta,* Roths., Nov. Zool., IX., Suppl., p. 720 (1903).

Habitat.—EUROPE TO S. ENGLAND and S. SWEDEN ; CAUCASUS.

Subsp. 1, *dahli,* Geyer. Hübn. Samml. Eur. Schmett. Sphing., pl. 36, f. 161·4 (1827).

Habitat.—CORSICA ; SARDINIA.

Subsp. 2, *tithymali,* Boisd. Icon. Hist. Lep. II. p. 30, pl. 51, f. 1 (1834).

Habitat.—CANARIES.

Subsp. 3, *mauretanica,* Staud. Cat. Lep., II., p. 36 (1871).

Deilephila deserticola, Bartel., Ruhl. Grosschemett, II., p. 79 (1899).

Habitat.—MOROCCO ; ALGIERS.

Subsp. 4, *conspicua,* Roths., Nov. Zool., IX., Suppl., p. 720 (1903).

Habitat.—ASIA MINOR ; SYRIA.

Subsp. 5, *siehei,* Pung. Berl. Ent. Zeit., XLVII., p. 235, pl. 3 (1903).

Habitat. CILICIA.

Subsp. 6, *centralasiæ,* Staud., Stett. Ent. Zeit., XLVIII., p. 64 (1887).

Habitat.—TRANSCASPIA ; AFGHANISTAN.

Subsp. 7, *robertsii,* Butl. P. Z. S., 1880, p. 411, pl. 39, ff. 9-10.

Deilephila peplides, Christ. Ent. Nacher., XX., p. 333 (1899).

Habitat.—TRANSCASPIA ; AFGHANISTAN.

Subsp. 8, *nervosa,* Roths. Nov. Zool., IX, Suppl., p. 721 (1903).

Habitat.—PUNJAB ; SIMLA.

Subsp. 9, *costata,* Norden. Bull. Mosc., XXIV., 2, p. 444, pl. xi ff. 3-4 (1851).

Habitat.—TRANSBAIKALIA.

155. CELERIO GALLII.

Sphinx gallii, Rott., Naturg., VI , . 107 (1775).

Deilephila phileuphorbia, Mutz., Wiegm. Arch. Naturg., VIII., pl. 171, pl. 8 (1840).

Habitat.—EUROPE ; W. & C. ASIA ; JAPAN ; KASHMIR.

Subsp. *intermedia,* Kirby, Faun. Bor. Am. IV., p. 302 (1834).

Deilephila chamænerii, Harris, Sillim. Journ. Sc., Art. XXXVI., p. 305 (1839).

,, *canadensis,* Guen. Am. Soc. Ent. Fr. 1868, p. 7.

Habitat.—Canada; U. S. A. to Colorado and Georgia.

155*a*. Celerio nicæa.

Sphinx nicæa, Prunner. Lep Pedem., p. 86 (1798).

,, *cyparissiæ*, Hübn. Samml. Eur. Schmett. Sphing. f. 115 (1827)

Habitat.—S. Europe; Caucasia; Transcaspia.

Subsp. 1, *castissima*, Austant, Le. Nat., V, p. 360 (1883).

Deilephila carnea, Austant, Le. Nat., XI., p. 232 (1889).

Habitat—Morocco; Algiers.

Subsp. 2, *lathyrus*, Wlk., VIII., 172 (1856).

Habitat.—Punjab; Kumaon.

155*b*. Celerio zygophylli.

Sphinx zygophylli, Ochs. Schmett., II., p. 226 (1808).

Habitat.—S. Russia; W. & C. Asia; Persia; Afghanistan.

153. Celerio lineata.

Sphinx lineata, Fabr. Syst. Ent., p. 541 (1775).

,, *daucus*, Cram. Pap. Exot., II., p. 41, pl. 125, f. D (1777).

Habitat.—Canada to Argentina.

Subsp. *livornica*, Esp. Schmett., II., p. 88 (1779).

Sphinx koechlini, Fuessly, Arch. I., p. 1, pl. 4 ff. 1-4 (1781).

Habitat.—S. Europe; N. Africa; Natal; W. & C. Asia; Persia; Afghanistan; China; Punjab; Bengal, Calcutta.

Genus Pergesa.

	Type.
Pergesa, Wlk., VIII., 149 (1856)	*porcellus.*
Cinogon, Butl., Trans. Ent. Soc., 1881, p. 1	*askoldensis.*
A. Hindwing with the terminial area bright rosy red	*elpenor.*
B. Hindwing with the terminal area suffused with cinnamon	*rivularis.*

119. Pergesa elpenor.

Sphinx elpenor, Linn. Syst. Nat., X., p. 491 (1758).

,, *porcus*, Retz. Gen. Ins., p. 34 (1783).

Elpenor vitis, Oken, Lehrb. Naturg. III.-I., p. 760 (1815).

Deilephila standfussi, Bartel, Rühl. Gross Schm. II., p. 122 (1900).

Metopsilus elpenorellus, Staud. Cat. Lèp. pal., p. 104 (1901).

Habitat.—Europe; W. & C. Asia; Amurland.

Subsp. 1, *lewisi*, Butl., P. Z. S., 1875, p. 247.

Habitat.—Japan; China.

Subsp. 2, *macromera*, Butl., P. Z. S., 1875, p. 7.

Habitat.—Assam.

119*a*. Pergesa rivularis.

Chærocampa rivularis, Boisd. Spec. Gén. Lép. Hét., I., p. 280 (1875).

,, *fraterna*, Butl., P. Z. S., 1875, p. 247.

Habitat.—Chitral; Punjab; Sikhim; Sind.

Genus Hippotion.

	Type.
Hippotion, Hübn., Verz., p. 134 (1827)	*celerio.*
Isoples, Hübn., Verz., p. 134 (1827)	*eson.*
A. Hindwing not red	*velox.*
B. Hindwing red or ferruginous, at least on basal area.	
a. Hindwing with black postmedial band	*celerio.*
b. Hindwing without black postmedial band.	
*a*¹. Hindwing with the base black	*echeclus.*
*b*¹. Hindwing with the base red.	
*a*². Palpi with prominent white lateral line near eye	*rafflesi.*
*b*². Palpi without prominent white lateral line near eye	*boerhaviæ.*

127. Hippotion velox.

Sphinx velox, Fabr., Ent. Syst. III., I., p. 378 (1793).
„ *vigil*, Guér. Deless, Voy. Ind., II., p. 80, pl. 25, f. 1 (1843).
Panacra lignaria, Wlk., VIII., 156 (1856).
Sphinx phœnyx, Herr. Schäff. Ausser. Eur. Schmett., f. 478 (1856).
Chœrocampa swinhœi, Moore, P. Z. S., 1862, p. 362.
„ *yorkii*, Boisd., Spec. Gén. Lép. Hét., I., p. 248 (1875).
Panacra rosea, Roths., Nov. Zool., I., p. 79, pl. 6, f. 14 (1894).
„ *lifuensis*, Roths., Nov. Zool., I., p. 79 (1894).
„ *griseola*, Roths., Nov. Zool., I., p. 80 (1894).
„ *pseudovigil*, Roths., Nov. Zool., I., p. 80 (1894).

Habitat.—N. & S. India; Ceylon; Burma; Andamans; Nicobars; Penang; Java; Christmas I.; Lombok; Sumba; Tenimber Is.; Amboina; Buru; New Guinea; d'Entrecasteaux Is.; Louisiades; Queensland; Lifu; Fiji.

123. Hippotion celerio.

Sphinx celerio, Linn. Syst. Nat., X., p. 491 (1758).
„ *tisiphona*, Linn. Syst. Nat., X., p. 492 (1758).
Phalæna inquilinus, Harris, Esp. Engl. Ins., p. 93, pl. 28, Lep. f. 1 (1781).
Hippotion ocis, Hübn. Verz., p. 135 (1827).
Deilephila albolineata, Montr. Am. Soc. Linn. Lyon (2), XI. p. 250 (1864).

Habitat.—Old World except far north and New Zealand.

121. Hippotion echeclus.

Chærocampa echeclus, Boisd., Spec. Gén. Lép. Hét., I., p. 233 (1875).
„ *elegans*, Butl., P. Z. S., 1875, p. 8, pl. 2, f. 1.

Habitat.—Assam; Madras, Madura; Burma, Bassein; Sumatra; Philippines; Java; Lombok; Celebes; Sumba.

122*a*. Hippotion rafflesi.

Chærocampa rafflesi, Butl. Trans. Zool. Soc., IX., p. 556 (1877).
„ *vinacea*, Hmpsn. Ill. Het. B. M., IX., p. 57, pl. 157, f. 2 and pl. 175, f. 2, 2 *a* (1893).

Habitat.—N. & S. India; Ceylon; Sumatra; Java; Celebes.

122. Hippotion boerhaviæ.

Sphinx boerhaviæ, Fabr. Syst. Ent., p. 542 (1775).
„ *vampyrus*, Fabr. Mant. Ins. II., p. 98 (1787).
„ *octopunctata*, Gmel. Syst. Nat., I., 5, p. 2386 (1790).
Chærocampa rosetta, Swinh. Cat. Het. Mus. Oxon., p. 16 (1892).

Habitat.—N. & S. India; Ceylon; Burma; Malacca; Penang; Bunguran; Natuna Is.; Sumatra; Borneo; Java; Lombok; Sumba; Celebes; Kisser; Larat; Key Is.; New Guinea; Trobriand Is.; Louisiades; Woodlark; N. Pommern; N. Lanenberg; N. Hanover; Solomons; Queensland.

Genus Theretra.

	Type.
Theretra, Hübn., Verz., p. 135 (1827)	*nessus.*
Oreus, Hübn., Verz., p. 136 (1827)	*gnoma.*
Gnathostypsis, Wllgrn. Œfv. Vet. Ak. Förh., XV., p. 137 (1858)	*capensis.*
Hathia, Moore, Lep. Ceyl. II., p. 19 (1882)	*latreilei.*

A. Hindwing red.
  a. Hindwing with the base black.
    a^1. Thorax with dorsal grey stripe; abdomen without lateral basal black patches .... *suffusa.*
    b^1. Thorax without dorsal grey stripe; abdomen with lateral basal black patches .... *alecto.*
  b. Hindwing with the base red .... *pallicosta.*
B. Hindwing not red or with narrow, ill-defined reddish tawny band.
  a. Abdomen with dorsal lines or tawny or ochreous subdorsal stripes arising from segment 3 and no prominent lateral basal black patches.
    a^1. Palpus with the cavity large and sharply defined. *nessus.*
    b^1. Palpus with the cavity more or less concealed or made irregular by rough scaling.
      a^2. Forewing with broad grey subterminal band ... *griseomarginata*
      b^2. Forewing without broad grey subterminal band.
        a^3. Forewing with the stigma situated on an ill-defined dark patch, postmedial band curved or indistinct except at inner margin where with the antemedial band it forms a square patch, or the wing nearly all brown .... *insignis.*
        b^3. Forewing with the stigma isolated, followed by a straight oblique dark band, formed of two or three distinct lines.
          a^4. Abdomen with the pale dorsal line simple, white .... *pinastrina.*

b^4. Abdomen with the pale dorsal line more or less prominently formed of two lines.

a^5. Forewing with the dark postmedial band formed by lines 1·2·3, the last heavier than line 2 .... *oldenlandiæ.*

b^5. Forewing with the dark postmedial band formed by lines 1·2, line 3 separate and not so heavy as line 2, especially towards inner margin .... *lycetus.*

b. Abdomen without dorsal lines, or with black lateral basal patch and without yellowish subdorsal stripe.

a^1. Palpus with the cavity at end of 1st joint partially concealed by rough scaling.

a^2. Abdomen above olive chestnut, below ferruginous or red .... *castanea.*

b^2. Abdomen above drab, below buff or vinaceous buff .... *latreillei.*

b^1. Palpus with the cavity at end of 1st joint sharply defined.

a^2. Forewing with series of dark points on the line arising from apex .... *boisduvali.*

b^2. Forewing without series of dark points on the line arising from apex, or the line incurved to costa; abdomen without dorsal lines.

a^3. Forewing with the apical line joining a postmedial line with which it forms a single line from apex to inner margin .... *clotho.*

b^3. Forewing with the apical line, if present, separate from the postmedial line which is incurved towards costa .... *gnoma.*

157. THERETRA NESSUS.

Sphinx nessus, Drury., Illustr. Ex. Ins., II., p. 46, pl. 76, f. 1 (1773).

„ *equestris*, Fabr., Ent. Syst. iii., I., p. 365 (1793).

Chærocampa rubicundus, Schaufuss, Nung. Otiosus I., p. 18 (1870).

Habitat.—JAPAN; PUNJAB; SIKHIM; BHUTAN; ASSAM; BOMBAY; MADRAS; CEYLON; BURMA; MALACCA; SUMATRA; NIAS; BORNEO; JAVA; LOMBOK; ALOR; TENIMBER; AMBOINA; NEW GUINEA; LOUISIADES; D'ENTRECASTEAUX IS.; TROBRIAND IS.; QUEENSLAND; LIFU.

141*a*. THERETRA BOISDUVALI.

Sphinx boisduvali, Bugn., Ann. Soc. Ent. Fr., 1839, p. 115.

Chærocampa punctivenata, Butl., P. Z. S., 1875, p. 248.

Habitat.—TURKEY; ASIA MINOR; SIKHIM; ASSAM; SUMATRA; BORNEO; JAVA; LOMBOK.

141. THERETRA CLOTHO.

Sphinx clotho, Drury, Illustr. Ex. Ins., II., p. 48, pl. 28, f. 1 (1773).
Deilephila cyrene, Westwd., Catt. Or. Ent., p. 13, pl. 6, f. 1 (1848).
Chœrocampa bistrigata, Butl., P. Z. S., 1875, p. 249.
,, *aspersata*, Kirby, Trans. Ent. Soc., 1877, p. 241.

Habitat.—N. & S. INDIA ; CEYLON ; ANDAMANS ; MALACCA ; SUMATRA ; BORNEO ; PHILIPPINES ; JAVA ; LOMBOK ; SUMBA ; DILI ; TIMOR ; CELEBES.

Subsp. *celata*, Butl., P. Z. S., 1877, p. 472.
Chœrocompa luteotincta, Lucas, Queenslander, XXXIX., p. 894 (1891).
,, *cloacina*, Miskin, Pr. Roy. Soc. Queensl., VIII., p. 16 (1891).
Theretra lifuensis, Roths., Nov. Zool., I., p. 78 (1894).

Habitat.—NEW GUINEA ; FERGUSSON I.; TROBRIAND IS.; ST. AIGNAN ; BOUGU ; SOLOMONS ; QUEENSLAND ; LIFU ; AMBOINA ; CERAM ; TENIMBER ; KEY IS.

141*b*. THERETRA GNOMA.

Sphinx gnoma, Fabr., Syst. Ent., p. 526 (1775).
,, *butus*, Cram., Pap. Exot , II., p. 88, pl. 152, f. A. (1777).
Chœrocampa gonograpta, Butl., P. Z. S., 1875, p. 249.

Habitat.—S. INDIA ; CEYLON.

140. THERETRA LATREILLEI.

Sphinx latreillei, MacLeay, King's Surv. Austr., II., p. 464 (1827).
Chœrocampa comminuens, Wlk., xxxi, 31 (1864).
,, *deserta*, Butl., Trans. Zool. Soc., IX., p. 638 (1877).
,, *walducki*, Butl., Trans. Ent. Soc., 1877, p. 398, pl. 9, f. 2.
,, *amara*, Swinh., Cat. Het. Mus. Oxon., p. 17, pl. 1, f. 9 (1892).

Habitat.—AMBOINA ; CERAM ; BOURN ; OBI ; KEY IS. ; ARU ; NEW GUINEA ; QUEENSLAND ; W. AUSTRALIA ; BISMARCK ARCH. ; SOLOMONS.

Subsp. *lucasi*, Wlk., VIII, 141 (1856).
Deilephila spilota, Moore, Cat. Lep. E. I. C., p. 277 (1857).
Chœrocampa procne, Clemens, Journ. Ac. Nat. Sci. Philad., IV, p. 151 (1859).
,, *tenebrosa*, Moore, Lep. Ceyl., II., p. 20, pl. 86, f. 2·2*a* (1882).

Habitat.—N. & S. INDIA ; CEYLON ; MALACCA ; ANDAMANS ; SUMATRA ; NIAS ; BORNEO ; PHILIPPINES ; LOMBOK ; SUMBA ; CELEBES ; DAMMER I.

120. THERETRA ALECTO.

Sphinx alecto, Linn., Syst. Nat., X., p. 492 (1758).

Habitat.—FORMOSA ; N. & S. INDIA ; BORNEO ; NIAS ; JAVA ; SUMBAWA ; SUMBA ; CELEBES ; LARAT ; TENIMBER ; KEY IS.

Subsp. *cretica*, Boisd., Ann. Soc. Linn., Paris, 1827, p. 118, pl. 6, f. 5.
Theretra freyeri, Kirby, Cat. Lep. Het., I., p. 650 (1892).

Habitat.—ASIA MINOR ; SYRIA ; PERSIA ; TRANSCAUCASIA ; W. TURKISTAN.

121*a*. THERETRA SUFFUSA.

Chœrocampa suffusa, Wlk., VIII., 146 (1856).
,, *hector*, Boisd., Spec. Gén. Lép. Hét., I., p. 230 (1875).

Habitat.—CHINA ; N. INDIA ; PENANG ; PERAK ; SINGAPORE ; SUMATRA ; BORNEO ; JAVA.

124. THERETRA LYCETUS.

Sphinx lycetus, Cram., Pap. Exot. I., p. 96, pl. 61, f. D (1775).

Chærocampa rosina, Butl., P. Z. S., 1875, p. 248, pl. 37, f. 6.

„ *prunosa,* Butl., P. Z. S., 1875, p. 622.

Habitat.—Punjab ; Sikhim ; Ceylon ; Burma ; Penang ; Java.

125. Theretra oldenlandiæ.

Sphinx oldenlandiæ, Fabr. Syst. Ent., p. 542 (1775).

„ *drancus,* Cram., Pap. Exot., II., p. 56, pl. 132, f. F (1777).

„ *argentata,* Haw., Trans. Ent. Soc., 1842, p. 334, non descr.

Xylophanes gortys, Hübn., Samml. Exot. Schmett., Zutr., III., p. 28, ff. 513·14 (1827).

Chærocampa sordida, Wlk., VIII., 148 (1856).

„ *puellaris,* Butl., P. Z. S., 1875, p. 623.

Deilephila proxima, Austant, Le Nat., 1892, p. 69.

Habitat.—Japan ; China ; Formosa ; N. & S. India ; Ceylon ; Penang ; Sumatra ; Borneo ; Philippines ; Java ; Sumba ; Celebes ; Amboina ; Key I. ; New Guinea.

Subsp. *formata,* Wlk., VIII., 148 (1856).

Habitat.—Queensland ; W. Australia ; N. S. Wales.

126. Theretra pinastrina.

Sphinx pinastrina, Martyn, Psyche, pl. 29, f. 81, and pl. 30, f. 85 (1797).

Chærocampa silhetensis, Wlk., VIII., 143 (1856).

„ *bisecta,* Moore, Lep. E. I C., p. 278, pl. 11, f. 5·5*a* (1857).

Habitat.—Japan ; Formosa; N. & S. India ; Ceylon ; Burma ; Penang ; Sumatra ; Borneo ; Java.

Subsp. *intersecta,* Butl., P. Z. S., 1875, p. 623.

Habitat.—Philippines ; Celebes ; Sumba ; Amboina ; New Guinea ; Bismarck Arch ; Solomons ; Queensland.

128. Theretra insignis.

Panacra insignis, Butl., A. M. N. H. (5), X., p. 432 (1882).

Habitat.—Andamans.

Subsp. *kuehni,* Roths., Nov. Zool., VII., p. 274, pl. 5, f. 2 (1900).

Habitat.—Java ; Dammer I.; Tenimber.

130*a*. Theretra griseomarginata.

Chœrocompa griseomarginata, Hmpsn., J. Bomb. N. H. Soc., XI., p. 281, pl. A., f. 12 (1898.)

Habitat.—Sikhim.

144. Theretra pallicosta.

Chærocampa pallicosta, Wlk., VIII., 145 (1856).

Habitat.—Hongkong ; Assam ; Canara ; Ceylon ; Burma.

138. Theretra castanea.

Pergesa castanea, Moore, P. Z. S., 1872, p. 566.

Chærocampa hyporhoda, Hmpsn., J. Bomb. N. H. Soc., XIII., p. 39, pl. B., f. 12 (1900).

Habitat.—Canara.

Genus RHYNCHOLABA.

Type.

Rhyncholaba, Roths., Nov. Zool. IX., Suppl. p. 789 (1903)...... *acteus.*

158. RHYNCHOLABA ACTEUS.

Sphinx acteus, Cram., Pap. Exot., III., p. 93, pl. 248, f. A (1779).

Panacra butleri, Roths., Nov. Zool., I., p. 80 (1894).

Habitat.—N. & S. INDIA ; CEYLON ; PENANG ; BORNEO ; NIAS ; JAVA ; LOMBOK ; SUMBAWA ; SUMBA ; BOURN.

Genus RHAGASTIS.

Type.

Rhagastis, Roths., Nov. Zool., IX,, Suppl., p. 791 (1903)...... *velata.*

- A. Hindwing on underside with prominent black stigma *albomarginatus.*
- B. Hindwing on underside without black stigma.
  - *a.* Palpus with the 2nd joint much constricted at base. *acuta.*
  - *b.* Palpus with the 2nd joint not constricted at base.
    - a^1. Thorax dorsally suffused with red ; underside of body and wings rosy red .... *gloriosa.*
    - b^1. Thorax not dorsally suffused with red.
      - a^2. Forewing with single series of prominent white subterminal lunules .... *lunata.*
      - b^2. Forewing with two series of white spots, or broad diffused band or no white subterminal markings.
        - a^3. Forewing with series of white subterminal spots preceded by a straight white line from apex to vein 4, then a lunulate line to vein 1 ; underside of body and wings ochreous .... *olivacea.*
        - b^3. Forewing without these markings.
          - a^4. Wings on underside densely irrorated with brown ; terminal band of forewing not conjoined to brown basal area ; no white subterminal scaling on forewing above ; abdomen with lateral yellow stripe .... *velata.*
          - b^4. Wings on underside less densely irrorated with brown ; forewing with the terminal band conjoined to basal brown area between veins 5 and 4.
            - a^5. Forewing on underside with the costal half of cell of the reddish colour of disk ; abdomen without yellowish lateral stripe ; forewing with the costal edge pale creamy... *confusa.*

b^5. Forewing on underside with the cell wholly brown ; abdomen ventrally yellowish white ; forewing on underside with the stripe connecting the basal and terminal areas heavy .... *aurifera.*

137. RHAGASTIS VELATA.

Pergesa velata, Wlk., XXXV., 1853 (1866).

Habitat.—SIKHIM ; BHUTAN ; ASSAM.

137*a*. RHAGASTIS ACUTA.

Zonilia acuta, Wlk., VIII., 195 (1856).

Habitat.—SIKHIM ; BHUTAN ; ASSAM ; PENANG.

137*b*. RHAGASTIS AURIFERA.

Pergesa aurifera, Butl., P. Z. S., 1875, p. 7.

Habitat.—SIKHIM ; BHUTAN ; ASSAM.

137*c*. RHAGASTIS CONFUSA.

Theretra albomarginata, Hmpsn., J. Bomb. N. H. Soc., XIII, p. 39, pl. B, f. (1900) nec Roths.

Rhagastis confusa, Roths., Nov. Zool., IX, Suppl., p. 795, pl. 14, f. 12 (1903).

Habitat.—SIKHIM ; ASSAM.

137*d*. RHAGASTIS LUNATA.

Chærocampa lunata, Roths., Nov. Zool., VII., p. 274 (1900).

Habitat.—ASSAM ; KHASIS.

Subsp. *sikhimensis*, Roths. Nov. Zool., IX, Suppl. p. 797 (1903).

Habitat.—SIKHIM.

136. RHAGASTIS OLIVACEA.

Pergesa olivacea, Moore, P. Z. S., 1872, p. 566.

Habitat.—PUNJAB ; SIKHIM ; BHUTAN ; ASSAM.

135. RHAGASTIS GLORIOSA.

Pergesa gloriosa, Butl., P. Z. S., 1875, p. 246.

Habitat.—SIKHIM ; BHUTAN ; ASSAM.

135*a*. RHAGASTIS ALBOMARGINATUS.

Metopsilus albomarginatus, Roths., Nov. Zool., I., p. 78 (1894).

Habitat.—SIKHIM ; ASSAM.

Subsp. *everetti*, Roths., Nov. Zool., IX., Suppl., p. 799 (1903).

Habitat.—SUMATRA ; BORNEO.

Genus CECHENINA.

Type.

Cechenina, Roths., Nov. Zool., IX., Suppl., p. 799 (1903) ...... *helops.*

A. Forewing on upperside with five to seven almost straight lines on terminal half ; abdomen dorsally striped.

a. Mesonotum without pale medial band ; forewing with seven lines .... *minor,* *b.* Mesonotum with pale medial band ; forewing with eight lines .... *lineosa.*

B. Forewing on upperside without straight lines on terminal half ; abdomen not dorsally striped.

a. Forewing with broad subbasal umber brown band or patch .... *helops.*

b. Forewing without subbasal umber brown band.

a^1. Forewing with the basal area, also the thorax, dark green .... *mirabilis.*

b_1. Forewing with the basal area clay colour with a black spot .... *ægrota.*

142. CECHENINA MIRABILIS.

Chœrocampa mirabilis, Butl., P. Z. S., 1875, p. 248.

Habitat.—PUNJAB.

142*a.* CECHENINA ÆGROTA.

Chœrocampa ægrota, Butl., P. Z. S., 1875, p. 246.

Theretra catori, Roths., Nov. Zool., I., p. 75 (1894).

Daphnis chimæra, Roths., Nov. Zool., I., p. 86, pl. 6, f. 16 (1894).

Habitat.—ASSAM ; PERAK ; BORNEO ; JAVA.

139. CECHENINA HELOPS.

Philampelus helops, Wlk., VIII., 180 (1856).

„ *orientalis,* Feld., Reis. Nov., pl. 77, f. 1 (1874).

Habitat.—SIKHIM ; ASSAM ; MALACCA ; SUMATRA ; BORNEO ; JAVA.

Subsp. *papuana,* Roths., Nov. Zool., IX., Suppl., p. 802 (1903).

Habitat.—NEW GUINEA ; NEU POMMERN.

143*a.* CECHENINA MINOR.

Chœrocampa minor, Butl., P. Z. S., 1875, p. 249.

Theretra striata, Roths., Nov. Zool., I., p. 76 (1894).

Habitat.—JAPAN ; FORMOSA ; SIKHIM ; BHUTAN ; ASSAM ; SIAM.

143. CECHENINA LINEOSA.

Chœrocampa lineosa, Wlk., VIII., 144 (1856).

„ *major,* Butl., P. Z. S., 1875, p. 249.

Habitat.—PUNJAB ; SIKHIM ; BHUTAN ; ASSAM ; MALACCA ; SUMATRA ; BORNEO.

NOTODONTIDÆ.

237*a.* PYDNA ENDOPHÆA, n. sp. (Pl. D. f. 1).

♂. Ochreous : head and thorax tinged with brown ; palpi dark brown at sides. Forewing with the inner margin narrowly red-brown ; the wing sparsely irrorated with rufous ; two rather obscure antemedial series of rufous points angled on median nervure ; a point below costa above angle of cell ; two obscure postmedial series met at vein 4 by an oblique series from apex, then oblique to the antemedial series on inner margin ; a subterminal and a terminal series. Hindwing rather yellower.

Habitat.—KANARA, Karwar (Davidson). *Exp.* 38 mill. Type in B. M.

238*b.* PYDNA FRUGALIS, Leech, Trans. Ent. Soc., 1898, p. 302.

♂. Brownish grey ; palpi and frons dark brown ; abdomen tinged with reddish brown. Forewing irrorated with a few dark scales and tinged with reddish brown, especially on inner and terminal areas ; two black points near base ; antemedial black points on costa and below cell ; an indistinct postmedial crenulate curved line with black points on the veins and a fuscous mark on it beyond lower angle of cell joined by an oblique streak from apex ; a terminal series of black points. Hindwing strongly tinged with fuscous brown.

♀. More rufous.

Habitat.—W. CHINA, Pu-tsu-fang, Moupin ; N.-W. HIMALAYAS, Kangra Valley 4500′ (Dudgeon).

Exp. ♂ 42, ♀ 48 mill.

241. PYDNA SIKKIMA, insert (syn.) *Pydna essa*, Swinh. A. M. N. H. (6), XVII., p. 360.

262*a*. STAUROPUS MIOIDES, n. sp.

♂. Head and thorax grey-white tinged with green ; branches of antennæ red-brown ; palpi black at sides ; abdomen whitish, dorsally fuscous, except at extremity. Forewing whitish tinged with green, especially towards base and thickly irrorated with dark-brown ; a small dark spot below origin of vein 2 and another at lower angle of cell placed on a fine indistinct line excurved from below costa to vein 5, then bent inwards to lower angle of cell ; a subterminal series of dark-brown spots, those below costa and above vein 5 displaced inwards ; a series of oblique dark striæ on termen. Hindwing dark reddish brown ; the costal area whitish tinged with green and irrorated with dark brown and with diffused dark postmedial and subterminal bars ; inner margin and cilia white ; the underside white.

Habitat.—ASSAM ; Khasis. *Exp.* 46 mill. Type in B. M.

280. DICRANURA HIMALAYANA.

Larva pale green ; the dorsal area whitish ; the 3rd somite produced to a somewhat pointed hump ; a subdorsal white line angled upwards below the hump ; stigmata ringed with black ; anal somite produced to two long flagellate tails, whitish granulated with black, the terminal halves crimson. Food plant willow (G. C. Dudgeon).

307. SPATALIA ARGENTIFERA ♂=309 *S. costalis* ♀. Specimens of both sexes bred (T. R. Bell).

317*a*. ICHTHYURA TRANSECTA.

Larva. Grey-brown with a broad dorsal dirty white line interrupted by a dark brown patch at 4th somite which is slightly humped ; lateral and sublateral series of yellow-brown tubercles ; a pale line above the lateral series of tubercles ; 4th somite with two pale red tubercles on a red patch in the centre of the brown one and with two white patches on each side of it ; a similar red patch with tubercles on 11th somite. Head dark brown clothed with whitish hair similar to that arising from the tubercles.

Food plant *salix babylonica.*

Pupa red in a slight cocoon formed of the leaves.

SYNTOMIDÆ.

403*b*. CERYX PLEURASTICTA, Hmpsn., A. M. N. H. (7), VIII., p. 165 (1901) (pl. D. f. 2).

♂. Purple-black ; back of head orange ; pectus with lateral orange spots ; tarsi with the 1st joint white ; abdomen with dorsal orange patch on 1st segment and band on 5th, the intermediate segments with lateral spots. Forewing with hyaline spot below the cell near base ; a wedge-shaped patch in end of cell and another below base of vein 2 ; a round spot above base of vein 2 and more elongate spots above veins 3·4 and 6. Hindwing with hyaline patch below middle of cell and round spot above vein 2.

Habitat. KANARA, Siddapah (Davidson). *Exp.* 24 mill.

451*a*. SYNTOMIS MADURENSIS, Hmpsn., A. M. N. H. (7), VIII., p. 166 (1901) (pl. D. f. 27).

♂. Antennæ with long branches ; black-brown ; frons and patagia with orange patches ; hind tibia with orange streak ; tarsi with the 1st joint orange ; abdomen with orange bands on 1st and 5th segments and small spots on terminal segment. Forewing with quadrate hyaline spots below base and in end of cell ; an oblique spot below vein 2 ; spots above veins 3 and 4 and a smaller spot above 6. Hindwing with orange medial band from cell to inner margin.

Habitat.—MADURA, Ammanaya-nahramir (Campbell). *Exp.* 22 mill.

455. ERESSA CONFINIS, insert (syn.) *Eressa catoria*, Swinh., A. M. N. H. (7) 6, p. 305.

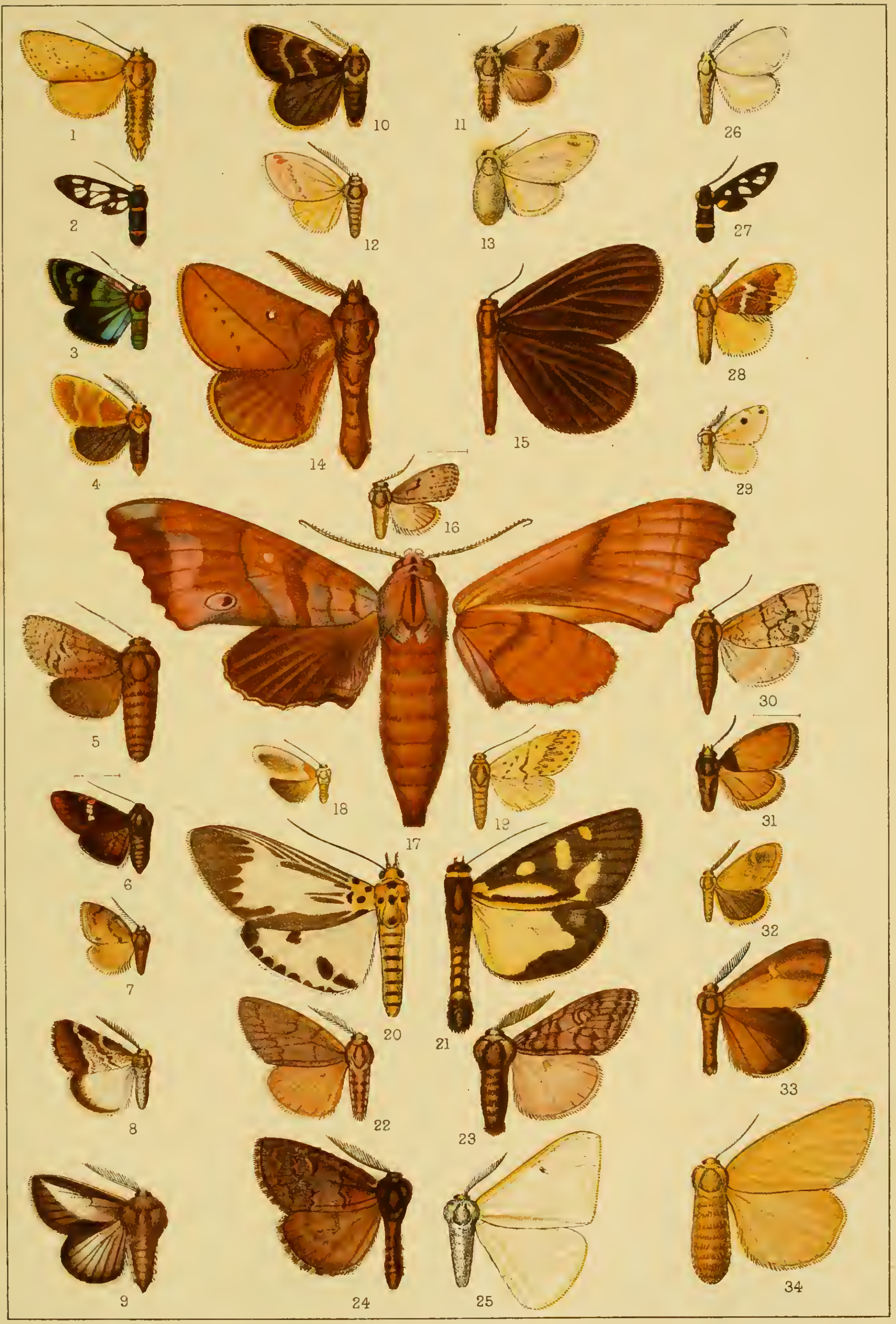
(*To be continued.*)

MOTHS OF INDIA (HAMPSON).

Description of Plate D.

1. *Pydna endophœ.*
2. *Ceryx pleurasticta.*
3. *Clelea refulgens.*
4. *Euproctis fulvinigra.*
5. *Cossus rufidorsia.*
6. *Striglina ignepicta.*
7. *Cania plumbifusa.*
8. *Aroa campbelli.*
9. *Lenodora hyalomelœna.*
10. *Euproctis laniata.* ♂
11. ,, *laniata.* ♀
12. ,, *xanthosticta.* ♂
13. ,, *xanthosticta.* ♀
14. *Odonestis fossa.*
15. *Ratarda furvivestita.*
16. *Nola brachystria.*
17. *Marumbanympha.*
18. *Ovipennis binghami.*
19. *Asura obliquilinea.*
20. *Hypsa donatana.*
21. *Macrobrochis flavicincta.*
22. *Lymantria mœsta.*
23. *Dasychira cerebosa.*
24. ,, *magnalia.*
25. *Leucoma pellucida.*
26. *Euproctis virgo.*
27. *Syntomis madurensis.*
28. *Euproctis mirabilis.*
29. ,, *macrostigma.*
30. *Paracossus furcata.*
31. *Idonauton nigribasis.*
32. *Euproctis dana.*
33. *Pantana ochrota* ♂
34. ,, *ochrota* ♀

Sir. G.F. HAMPSON, Journ. Bomb. Nat. Hist. Soc. Plate D.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Horace Knight ad nat lith West, Newman chromo.

INDIAN MOTHS.

MISCELLANEOUS NOTES.

No. I.—SOME NOTES ON BIRDS TAKEN AT COONOOR, NILGIRIS, IN MAY 1904.

Pomatorhinus horsfieldi.—The Southern Scimitar Babbler.

This bird is very common about Coonoor. It usually occurs in small flocks from three to eight in number. Although very partial to thick damp undergrowth these birds do not hesitate to enter gardens. I have seen them in wayside bushes and on a comparatively open hill-side on which there was a continuous chain of bushes and small trees. The birds keep well to cover. They are very skilled climbers, making their way with great facility through thick bushes and trees, progressing in much the same way that Crow-Pheasants do.

They are equally clever in running up and down tree trunks, being almost as nimble as nuthatches.

This Scimitar Babbler feeds on insects which it picks off leaves, off the ground, or from the trunks of trees. It uses its long bill as a probe, by means of which it drags out insects which lurk in the crevices of the bark of trees. On one occasion I saw one of these birds devouring something large which it held with its foot as a crow does, and took pecks at it. I was unable to make out the nature of the object but the bird took half a dozen bites at it before it was disposed of.

The bird has several notes, A common one is a loud *Ko-ko-ko-e-e-e.*

Sometimes one bird calls *Ko-ko-ko* and another answers *Ko-ee.* When the birds are feeding in company, they keep up a continuous chatter, which is not unpleasing to the ear. When alarmed this bird gives vent to a harsh cry very characteristic of the babbler tribe.

Its habits are so similar to those of the Nilgiri Laughing Thrush (*Trochalopterum cachinnans*), also very common about Coonoor, that it is difficult to determine which of the varied notes heard belong to each species.

Zosterops palpebrosa.—The Indian White-eye is very common in this part of the Nilgiris, being, in fact, almost as numerous as the Hill-Bulbul (*Otocompsa fuscicaudata*). I found several nests belonging to this species.

Most of them contained only two eggs. So far as I could determine, the eggs take twelve or thirteen days to hatch out.

Sitta frontalis.—The Velvet-fronted Blue Nuthatch is very numerous in the Coonoor forests.

I saw many Tailor birds (*Orthotomus sutorius*) some of which were in breeding plumage. Coonoor is about 6,000 feet above the sea-level. This bird therefore ascends higher than 4,000 feet, the limit given by Oates.

Cyornis tickelli.—Tickell's Blue Flycatcher is fairly abundant at Coonoor. It is a noisy bird, continually uttering a characteristic note. This consists of a couple of sharp *chicks*, followed by a little tune of about six notes, not unlike that of the White-browed Fan-tail Flycatcher but harsher and not so loud.

Stoparola albicaudata.—The Nilgiri Blue Flycatcher is numerous, not infrequently coming into gardens. Does this species feed on fruit as well as insects ?

Unless I am mistaken in the species, I have on several occasions seen both old and young birds eating fruit. I saw young birds on May 18th and 21st. The whole plumage, except the wings and tail, was brown, spotted with yellow.

Ochromela nigrirufa.—The Black and Orange Flycatcher is not uncommon about Coonoor. Jerdon's description of its habits is good, except that the eminent naturalist says "it is a very silent bird." The bird is anything but silent. It continually gives forth a cheeping note, one which might emanate from an insect. The bird always seems to take a low perch about two feet from the ground.

I saw a young bird on May 16th and another on May 21st. I saw the latter receive an insect from the mother.

The young birds are coloured as follows: The whole head, neck, breast, and (I think) the back is yellow, heavily spotted or mottled with dark-brown. The tail, which is very short and broad, is bright-yellow.

The abdomen and under-tail coverts are very pale-yellow. The note of the young bird closely resembles that of the adult.

Culicicapa ceylonensis.—The Grey-headed Flycatcher.

Its habits are rather phlegmatic for a Flycatcher. I have watched one in the early morning, sitting for five or ten minutes on end on a branch, looking very sleek and comfortable; but it was "taking in" everything, the head being in constant motion. The bird will then suddenly become very active for a few minutes, making a number of little sallies into the air, as is the wont of fly-catchers. It does not by any means always return to the perch it left, although it usually comes back to the same tree or bush. It has a feeble twittering note. It is not a shy bird, and will often allow one to approach within six feet of where it is perched, and when disturbed flies only a few yards. It is fairly common in the woods about Coonoor.

Rhipidura albifrontata.—The White-browed Fantail Flycatcher is very numerous about Coonoor. I came upon a nest placed in the fork of the lowest branch of a tree about ten feet from the ground. The nest was as described in Oates, in it were three eggs, also as described by him. These hatched out on May 19th. It is perhaps worthy of mention that, so far from these eggs being protectively coloured, I could easily distinguish them for a distance of 15 feet.

Æthiopsar fuscus is the common myna in this part of the world. One bird had a nest containing young, situated in the broken-off branch of an old tree. The young birds must have hatched out about May 5th.

D. DEWAR.

MADRAS, *May* 1904.

No. II.—THE OCCURRENCE OF THE BLACK-CAPPED KING-FISHER (*HALCYON PILEATA*) IN NORTH LAKHIMPUR, UPPER ASSAM.

On the 7th April *Halcyon pileata* made its appearance in this quarter, frequenting a jan which leaves the River Dejoo at the base of the Duphla hills and after flowing a tortuous course through open cleared ground joins the Runganuddie. I had some slight doubt as to my first observations being correct owing to a drizzling rain and bad light at the time ; but I had ample opportunities of noting its black head, white collar and dark blue colouring of the back compared with *H. smyrnensis* before the day closed. Whilst not very wary yet it gave one the impression that I was fresh to its surroundings and this dispelled any hopes I had that the bird was breeding in the vicinity, although some clumps of bamboos overlooking stagnant water afforded it a safe retreat, from the open steep clay banks of the jan where *H. smyrnensis* had located itself. As it has not made its appearance since that date, I am inclined to think it was performing a local migratory movement, possibly from a higher altitude during a period of very wet weather.

H. STEVENS.

North Lakhimpur, Upper Assam, *May* 1904.

No. III.—THE YELLOW-BELLIED FLYCATCHER (*CHELIDORHYNX HYPOXANTHUM.*)

The distribution of *Chelidorhynx hypoxanthum* in all probability extends across the plains in the Dibrugarh district during the cold season, as at that time it is fairly plentiful here. Contrary to Blanford's observations as to this species occurring in small flocks, on the dozen or so opportunities afforded me of observing this flycatcher, although once I noted three within a distance of 100 yards, each bird was acting independently and on the other occasions singles have invariably been the order. In habits it is truly Rhipidurean in the manner of darting out in quest of food and returning to the same perch; favourite localities frequented are forest-lined streams, brushwood and fallen trees in forest clearings and it very often haunts these quarters in company with *Culicicapa ceylonensis.* Measurements of specimens in the flesh. Length 4″, bill from gape ·3 which differ from Oates somewhat, 4·7 and ·4 respectively.

H. STEVENS.

Rungagora, Upper Assam, *January* 1904.

No. IV.—THE OCCURRENCE OF THE RED-BREASTED GOOSE (*BRANTA RUFICOLLIS*) IN INDIA.

In early April of this year I was asked by Mr. M. S. Moudy whether there were any geese found in India with red necks, and on my replying " no " he said that he had seen four such on the banks of the Brahmapootra in company with a large flock of the Common Grey Goose. He then gave me a minute description of these geese, from which I had not the slightest hesitation in identifying them as *Branta ruficollis*, the Red-Breasted Goose.

Mr. Mondy had no idea what he was describing and had seen no such geese before. These four had, however, differed so conspicuously from the others that he took a very careful note of their appearance although, unfortunately he was unable to obtain a specimen.

In the *Bengal Sporting Magazine* for 1836, VII., p. 247, it is said that four birds of this species were seen and one shot near Nagpur, but the article referred to is anonymous and of little value.

E. C. STUART-BAKER, F.Z.S.

DIBRUGARH, ASSAM, *July* 1904.

No. V.—THE OCCURRENCE OF THE MASKED FIN-FOOT (*HELIOPAIS PERSONATA*) IN LAKHIMPUR.

On the 14th June I had sent to me a very fine ♂ specimen of the Masked Fin-foot which was obtained by Dr. Gregerson in a forest bheel or swamp on the borders of this district. This bird which was breeding possessed a tiny fronted shield and a yellow horn or fronted wattle about ½″ long and which appeared to be erect during the bird's life. In colour it was a brilliant chrome yellow like the beak. I have never seen this wattle referred to and it appears to have been unnoticed up to now so that we may presume it to be seasonal.

On the 10th June, I believe in the same bheel, Dr. T. More obtained a fine female. The soft colours of this bird are far brighter than hitherto described, probably also due to the bird being in breeding condition.

E. C. STUART-BAKER, F.Z.S.

DIBRUGARH, ASSAM, *July* 1904.

No. VI.—THE ENEMIES OF BUTTERFLIES.

I have been interested in the letters which have appeared in the Journal lately on the subject of enemies of butterflies. The subject is of some importance in connection with the various forms of "protection" which are found among them. A great many writers seem to assume that the principal enemies against which butterflies have to guard themselves are birds, but I believe this is an utter mistake. In fact, I believe that butterflies can afford to disregard birds altogether. This is certainly not because birds do not like them as food, but because every bird soon finds out that they are not worth the trouble of catching. The peculiar zigzag flight of a butterfly makes it very difficult for even a king-crow, or a bee-eater, to capture one on the wing, and when it thinks it has succeeded, it gets a mouthful of wings and misses the body. I remember only two instances which have come under my own observation. In one case a bee-eater caught a *Danais*, but dropped it as soon as it had tasted it, and the *Danais* flew away little the worse. In the other case the butterfly, *Euthalia garuda*, had been slightly crippled by some accident, which a king-crow detected at once, but it had some trouble to catch it. The flight of a moth is straight and offers little difficulty, accordingly a moth can scarcely show itself by daylight without being pursued. Dragonflies can cope with butterflies, however, and constantly feed on the smaller kinds, especially the *Lycaenidæ*, which they may be seen hawking over grass. I once saw a large dragonfly feeding on a *Catopsilia catilla*, but in the case of a butterfly of that size it must be very difficult for even a dragonfly to get hold of the body in the midst of so much wing.

The real enemies of butterflies are, I believe, lizards and frogs and, no doubt, tree snakes. Therefore all protective colours and forms found among them are intended to conceal them when at rest. When a butterfly is found with a large piece torn out of both hind wings, as we so often find them, it has had a narrow escape from a lizard. *Kallima,* when at rest on the trunk of a tree, always turns its head downwards, though this somewhat spoils its resemblance to a leaf. I believe the reason is that the danger is greatest of a lizard ascending the tree. Chameleons are very fond of butterflies, epecially *Pierinæ.*

E. H. AITKEN.

KURRACHEE, 30*th June* 1904.

No. VII.—THE RECENT PLAGUE OF LOCUSTS IN BOMBAY.

With reference to the letter published in the last number of the Journal by Mr. A. B. Mosse, in which he states that, while *Acridium succinctum* was ravaging the country round Bombay, *Acridium peregrinum* was invading Mahi Kantha, Kaira and Ahmedabad, perhaps the results of my observations of these two species may be of some interest. *A. succinctum* (if there is no doubt about the correctness of the name) has long been a familiar insect to me as the big grasshopper of the Deccan. Even on the coast it is common, and sometimes very common, on hilly ground where there is long grass. But whenever there has been a visitation of locusts and I have been able to secure specimens, the species has been *A. peregrinum.* During the great plague of 1883, when Matheran and, I think, Mahabuleshwar too were reduced to desolation, many stragglers fell into Bombay and they were *A. peregrinum.* I have often met with them at other times, once as far south as Rutnagherry. But all I have seen have been manifestly visitors. Their breeding grounds are in the north. In Sind they are "endemic," breeding in the sandhills of Thar and Parkar and overspreading the province several times a year. On occasions, perhaps when for some reason they have been more prolific than usual, they set out on those great migrations which have given them such a terrible reputation since the days of Moses: for I believe there is no doubt that this is the species mentioned in the book of Exodus. Their powers of flight are marvellous. Especially when they first arrive they sail about with such ease and grace that I have mistaken them for huge dragonflies. I do not believe that *A. succinctum* can be compared with them in this respect, and I have always till lately refused to recognise it as a "locust" in the popular sense. But evidently it also, when times are hard, breaks out and overflows its proper limits. Unfortunately there appear to be no reliable records of the extent to which it may spread. It should surely be possible even now to ascertain exactly how far the present swarm has extended.

There is another curious fact to which attention should be directed. I have obtained, through the kindness of friends, two lots of specimens of this swarm and they are all of a rich red colour. From the accounts in the newspapers I gather that this has been their tint everywhere. Now the colour of *A.*

succinctum, wherever I have met with it living quietly at home, is a yellow, or yellowish green. Only the underwings have a rosy tinge. I have lately discovered, however, that *A. peregrinum* is subject to a similar change of colour. When a swarm arrives, its uniform is red ; but when it has passed away, the stragglers that remain soon acquire a pale yellow tint. Some become grey. Is the red colour of both species a symptom of the migratory fever, or the result of a long journey in the sun ?

E. H. AITKEN.

KURRACHEE, 30*th June* 1904.

No. VIII.—THE HIMALAYAN NUTCRACKER (*NUCIFRAGA HEMISPILA*).

Regarding the round holes made in walnuts, concerning which there has been much discussion in the Journal, may I venture to disagree with those who assign the cause to the action of a woodpecker.

During last season I had a house in Simla, and there was near it and overshadowing an outside "bachelor quarter," a large walnut tree in very full bearing. Every morning on the path below the tree and on the roof of the quarter were any number of walnuts with a neat circular hole driven completely through about the size of a two or four anna bit. The hole was evidently bored from outside of one side and the nut turned round to enable similar action to be taken with the other half.

I used to have the bored nuts carefully swept up daily and the tree watched. Never, did we see a nut fall during the day, nor did a woodpecker visit the tree but at dusk regularly flying squirrels came to the tree, and I am decidedly of opinion that they and not birds are the "culprits." Birds do not feed in this manner at night—the squirrels I refer to do.

Besides, look at the front upper teeth of this squirrel—they are long and hooked, and if I may say so, almost hinged to the jaw and are just the instruments to produce the noted result.

The squirrel, too, holds nuts in his paws when at work. How is the woodpecker going to manage ?

WILLIAM CAPPER, COLONEL,
D. M. E. in India.

SIMLA, 17*th July* 1904.

No. IX.—THE HIMALAYAN NUTCRACKER (*NUCIFRAGA HEMISPILA*).

When my copy of the Journal arrived I had the pleasure of seeing Mr. W. P. Masson and we read with interest Lt.-General Osborn's note on this bird and its walnut-eating propensities. I asked Mr. Masson to see if he had any notes on the subject, and he kindly sent me the following :—

"Anent that article in the Bombay Natural History Society's Journal, regarding the nutcracker (*Nucifraga hemispila*) breaking the shell of the walnut to get at the contents, it is entirely wrong as regards our bird in Sikhim. Our Sikhim birds are never found at a lower elevation than 9,500 ft. high, whereas the wild walnut is only found between 6 and 8,000 ft.; probably the walnuts in Kulu grow at a higher elevation and have a much thinner shell than those got in Sikhim. The shell of the walnut in Sikhim is intensely hard and takes a strong blow with a heavy hammer to break one and what is there in it after breaking—just a thin streak of hard woody flesh. No nutcracker or woodpecker could ever bore into one of these wild walnuts; if they attempted to do so their bills would probably break long before any impression was made. I have seen nutcrackers tearing the moss off a rhododendron shrub to get at the insects and larvæ which congregate underneath. I have also seen them on the high ranges in September feeding on a sort of red raspberry which ripens there." I suggest the following:—If these holes are not made by a rodent, which is most probable, as suggested by Mr. Osmaston they might perhaps be formed by a grub which had got into the walnut before the shell hardened and which had either worked its way through or else eaten the inner coating of the shell and thus made it thinner. As nutcrackers sometimes and woodpeckers always feed on insects, they might probably be noticed probing these holes or breaking the thin shells in search of the larvæ which they contained. I spoke to some forest officers about this and they thought it quite possible.

CHAS. M. INGLIS.

DARJEELING, 22*nd July* 1904.

No. X.—THE BLACK STORK ? (*CICONIA NIGRA ?*)

On the 29th November 1903, we observed a flock of some 30 birds, undoubtedly storks, fishing in the shallows off a sand bank. They were very wary, and unfortunately, owing to a number of boats and people being about at the far end of the sand bank, it would have been unsafe to use a high velocity rifle, and they would not permit any one to get close enough to use a scatter gun.

Owing to their fishing and playing about, and while some slept and others sunned themselves, we were able by the aid of a very good telescope and binoculars to make out a good deal about them. The notes I made on a slip of paper are as follows:—

Body, dark blackish glossed with bronze. Upper breast bronze green, lower breast, abdomen, flanks, and under tail, white. Beak, legs and around eyes, crimson. From this it occurred to me that they could hardly be any other than a flock of black storks (*Ciconia nigra*). They were the only ones seen on the trip down from Myitkyina and I have never met with these birds on any previous trip or for the matter of that anywhere else in the province.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 16*th July* 1904.

No. XI.—THE GREAT WHITE-BELLIED HERON (*ARDEA INSIGNIS.*)

On the 29th November 1903, I was at Hsenbo, a station above the first defile on the Upper Irrawaddy. I saw a very large heron, unknown to me, sitting on a half stranded snag at the end of a bank, and I asked Col. S.............. who was with me to try and shoot the bird with his ·303. He missed the first shot; the second, however, dropped the heron which proved to be a splendid bird. Measurements and description were taken at once.

Length of bird from tip of beak to claw	5′-4″
Do. bill from eye to tip	8·25″
Do. tibia	9″
Do. tarsus (including claw)	7·25″
Spread of wing	40″
From tip to tip	84″
Length of wing bone	24″

Head.—Naked around eyes especially in front of and under eye skin greenish yellow colour.

Distinct crest or heron plume.

Throat.—White for 2″ under jaw.

Neck.—Grey or slatey with some long feathers towards base.

In these feathers the midrib was altogether white, while the barbs for more than half way were bluish; remaining feathers white.

Body, i.e., breast and abdomen—White, except for a few heron-like feathers on upper breast which were tinged grey. The outside of thighs were slatey blue. The under tail coverts, axillaries, etc., were quite white.

The wings and upper tail coverts slatey blue in colour. Mantle darkish slate. Colour of beak, legs, and feet blue black.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 16*th July* 1904.

No. XII.—THE ASIATIC TWO-HORNED RHINOCEROS (*RHINOCEROS SUMATRENSIS.*)

The following measurements of an adult female of this species were kindly taken for me by a friend who shot the animal:—

Length from muzzle to root of tail	7′-9″
Girth behind shoulder	6′-6″
Girth of forearm	2′-0″
Length of tail	1′-8″
Height at shoulder	4′-6″
Basal length of skull	1′-10½″
Zygomatic breadth	0′-11″
Horn anterior	4¾″
Horn posterior	1″

The skin, as regards distribution of hair, resembled that of an adult buffalo, and in its thickest part measured $\frac{5}{8}''$. The contents of the stomach consisted of wild mangoes and other fruit, leaves and twigs of a tree not recognized, and also twigs and leaves of a species of bamboo known locally as "Kayen-wa."

This cow had evidently quite recently dropped a calf, as she was in full milk. No calf was with her, though search was made near by, nor were any footmarks of a calf discovered. It is highly probable that the calf was killed by a tiger a few days after birth, more especially as the old cow was found to be severely bitten on one hind leg. The udder had two fairly large teats, each of which showed eleven largish openings.

Rather more than half a pint of milk was drawn off. It was thin watery of a bluish tint, had a very pronounced saline taste, but no markedly distinct odour. When discovered she was lying in a rocky pool. On being hit she rolled over on her side, but immediately recovered herself and charged, closely followed by a second rhino (bull), who had been up to this time unobserved, as he was behind some rocks. Fortunately a very lucky shot, at about six paces, killed the wounded animal, and as she fell her consort at once turned tail. When charging the wounded one gave peculiar grunts and kept her jaws open as though with every intention of biting. The people about the hills state that rhinos do bite.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 10*th July* 1904.

No. XIII.—LATE STAY OF SNIPE.

In No. IV of Volume XV I read some notes on the above subject. I am inclined to the opinion expressed by Mr. Aitken, *viz.*, that there are places where seclusion and good fare tempt a few birds to defer their migration.

In Lower Burma the snipe season may be said to be September and October, *i.e.*, we find the first snipe in about the middle of August and they are very scarce towards the end of October. Nevertheless, some snipe, after migrating temporarily somewhere or other, return to certain grounds in Lower Burma where good bags may be made in January and February, and I have on one or two occasions shot 10 to 15 couple early in March.

A large number of birds come to these particular grounds in some seasons, at others not so many. They evidently come more or less all together, as the number does not increase and a successful weekly visit means so many birds less for the next shoot. I have frequently seen a few (perhaps two or three couple of birds) on the edge of the Myitkyo swamp as late as the middle of April.

In Upper Burma they may also be found very late on certain grounds; for instance, last year in Kyaukse district there were any number of snipe on a ground where some fields were being irrigated from a tank. Unfortunately no snipe cartridges were at hand, so they were not molested, but with straight shooting a bag of twenty couple might have been made. This was on the 16th, 17th and 18th April. In this district there are certain very late grounds, that is, if visited in January a bag of 10 to 12 couple is as much as one can make by hard tramping and moderately straight shooting, whereas late in February or first week in March 50 couple or more may, with straight shooting, be got. The latest date I have recorded shooting a snipe is in the Myittha valley on the 12th May 1890, when I obtained 5 having seen perhaps a dozen—much higher up than where Captain Lane found them.

It would be interesting to know whether the snipe were fan or pintails. I am inclined to the opinion that the very late birds here are nearly always the latter. I observe Oates, in his Manual of the Game Birds of India, notes in Volume II, page 457, that they may very occasionally be met with in June. I have little doubt that in Burma certainly a few may be met with as late as this, and I would go as far as to say that I think there may be a few snipe who spend the year here in different suitable localities.

I fancy the Upper Chindwin district is the most likely district in which to find snipe staying very late.

These late snipe are, in my opinion, from a gastronomic point, not very good, being rather muddy and dry to the taste.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 16*th July* 1904.

No. XIV.—THE ANCESTRY OF THE HORSE.

With reference to the interesting letter, signed R. L., extracted from the *Field*, on the above subject, which appeared in this Journal, page 703, Vol. XV., I have been in some doubt as to what are his conclusions on the evidence produced.

At the time that *Equus sivalensis* flourished, we must suppose that the Sivaliks were not connected by land with Kattiawar and Peninsular India, or ever had been, while the present home of *Equus prejewalki* was probably under the sea. The existing genus *Equus* is characteristic of (though, of course, not confined to) the desert sub-region of the Palearctic region, *i.e.*, the comparatively narrow long strip of land reaching from Morocco to the frontier of Manchuria. Now, apart from its shape, it is, from the geologically recent origin of this land, hardly credible that a genus so isolated and therefore ancient as *Equus* could have originated there.

We must, therefore, suppose that the surviving species retreated therefrom one or other of the surrounding regions before the advance of man and other enemies, being so constituted that they could longest maintain their independence and existence in open steppe-like country.

The question is from which of the surrounding regions did they retreat. The historical evidence collected by Victor Hehn in the " Wanderings of Plants and Animals" goes to show very strongly that the horse was not a European animal, and I think, if we remember, that at the time the Sivalik deposits were forming, the Thibetan plateau was probably a comparatively low-lying upland ; we shall find this latter region the most likely original home of the horse.

I am not sufficiently an anatomist to know whether *sivalensis* can be regarded as a direct ancestor or only a collateral of the existing Mongolian horse ; but I would say in passing that the rudimentary presence of face glands in Asiatic horses as compared with their entire absence in the more highly domesticated horses of Europe (by domesticated, I mean more highly modified by the breeder's science), is no evidence whatever that they are descended from distinct wild species.

As to the Kattiawar ponies, it is now generally admitted that the Gujars were one of those tribes of "Scythians" who invaded India between the death of Asoka and Mahmud of Ghazni, and there is little doubt that the Kathis were of similar origin and brought their Mongolian ponies with them, the breed of which they have jealously preserved ever since.

L. C. H. YOUNG.

BOMBAY, *August* 1904.

No. XV.—BIRDS OBSERVED IN THE NILGIRIS AND WYNAAD.

Having now had the opportunity of overhauling a part of my collection of skins, I send these rough and unscientific notes (in the order in which I have gone through my specimens) on a few birds observed in the Nilgiris and Wynaad during a stay of 18 months in those parts. Some few of them and their eggs I was able fortunately to collect. Should these notes prove of any interest to members I shall be glad to continue them, but as they are likely to be very imperfect I should be glad of any aid that could be given me by any member who takes an interest in the birds of those districts. I start with Striges and Accipitres, having but just looked over these.

ORDER—STRIGES.

KETUPA ZEYLONENSIS.—The Brown Fish Owl.

Blanford, No. 1164.

This was common on the Nilgiris and even more so in the Wynaad.

HUHUA NEPALENSIS.—The Forest Eagle Owl.

Blanford, No. 1170.

I twice came across this fine owl in the Wynaad. I do not know if the cry of this bird be that of the "Devil bird," but my next-door neighbour, a Ceylon planter, called my attention one night to a most eerie cry (or series of yells) which he said was made by the Devil bird, and having seen a pair of these owls near the garden a day previously I concluded it might be their call (?)

SCOPS BAKKAMÆNA.—The Collared Scops Owl.

Blanford, No. 1178.

The species of Scops that I came across in the Nilgiris and Wynaad I conclude was this ; it was very common in the latter district, but I did not unfortunately collect it.

ATHENE BRAMA.—The Spotted Owlet.

Blanford, No. 1180.

I fear I overlooked this very common bird.

GLAUCIDIUM RADIATUM.—The Jungle Owlet.

Blanford, No. 1184.

I have seen this bird as high as 5,000 feet elevation in a shola near the Terramia Tea Estate, but I do not think it is common.

ORDER—ACCIPITRES.

Family—*Vulturidæ.*

OTOGYPS CALVUS.—The Black Vulture.

Blanford, No. 1191.

Not uncommon in either district; it breeds, I think, chiefly on precipices in this part of India. I saw a nest on some rocks near the Craigmore toll gate, Ooty.

GYPS INDICUS.—The Indian Long-billed Vulture.

Blanford, No. 1194.

This bird perhaps occurs, but I did not observe it.

PSEUDOGYPS BENGALENSIS.—The Indian White-backed Vulture.

Blandford, No. 1196.

This is, I think, the most common vulture, though these birds prefer to patronize the plains rather than the hills, and are nowhere really plentiful at the higher elevations.

NEOPHRON GINGINIANUS.—The White Scavenger Vulture.

Blanford, No. 1197.

This is a very common bird round Badaga and other villages. Nilgiris Kotagiri has a large colony round the filthy "Kota" village, in the centre of that pretty little station, though where they bred I was unable to discover. It is not quite so common in S. Wynaad.

FAMILY—*Falconidæ.*

Sub-Family—*Falconinæ.*

HIERAËTUS PENNATUS.—The Booted Eagle.

Blanford, No. 1208.

I believe both this and *H. fasciatus* are not uncommon on the Nilgiris, but my stay there was too limited for me to speak with certainty: perhaps, however, some member will kindly correct me if I be wrong. I have heard sportsmen speak of both.

LOPHOTRIORCHIS KIENERI—The Rufous-bellied Hawk-eagle.

Blanford, No. 1209.

I have a specimen of what I believe to be this bird shot in the Wynaad.

ICTINAËTUS MALAYENSIS.—The Black Eagle.

Blanford, No. 1210.

This very handsome eagle is a fairly common bird on the Nilgiris. I was told it bred on precipices (the Gunjara precipices) somewhere near Kil Kotagiri in company with many other hawks. For this, as for all the larger hawks and eagles, I believe the Nilgiri Game Association offers a reward, as they are said to be most destructive to small game.

Spizaëtus cirrhatus.—The Crested Hawk Eagle.

Blanford, No. 1211.

Observed in both districts.

Spilornis cheela.—The Crested Serpent Eagle.

Blanford, No. 1217.

I cannot recollect having seen this bird on the Nilgiris. I probably overlooked it ; it was, however, not uncommon in the heavy forests of the S. Wynaad.

Haliastur indus.—The Brahminy Kite.

Blanford, No. 1228.

This is not very abundant on "the hills" : still it is far from uncommon.

Milvus govinda—The Common Pariah Kite.

Blanford, No. 1229.

Common round stations,—not so much so on the tea and coffee estates out in the district.

Elanus cæruleus—The Black-winged Kite.

Blanford, No. 1232.

I saw a pair of these birds hawking, at Poda Padi, at the foot of the S. Wynaad hills. I do not know if it occurs at the higher elevations.

Circus macrurus—The Pale Harrier.

Blanford, No. 1233.

I saw a few of these birds near the Terramia Tea Estate during the cold weather, but I think Harriers generally are rather uncommon at the higher (5,000 ft. to 5,600 ft.) elevations.

Circus melanoleucus—The Pied Harrier.

Blanford, No. 1236.

Same remarks apply as to *C. macrurus*: if anything it may be met with a little more frequently, or perhaps its more boldly marked plumage catches the eye quicker (?)

Circus æruginosus—The Marsh Harrier.

Blanford, No. 1237.

I saw an old bird of this species at the edge of a small swamp near the Terramia garden.

Astur badius.—The Shikra.

Blanford, No. 1244.

Very common in both the Wynaad and Nilgiris.

Lophospizias trivirgatus.—The Crested Goshawk.

Blanford, No. 1246.

I saw a few specimens of this bird in the Wynaad. I do not think it can be common.

Accipter nisus—The Sparrow Hawk.

Blanford, No. 1247.

I did not personally observe it, but think it may likely occur in the Nilgiris and possibly breed ?

PERNIS CRISTATUS.—The Crested Honey Buzzard.

Blanford, No. 1249.

I collected two specimens of this bird and saw a few others.

FALCO SEVERUS.—The Indian Hobby.

Blanford, No. 1261.

I neither saw nor shot this bird in the Nilgiris myself, but was told it bred in that seeming paradise for eagles and hawks, the Gunjarra precipices.

TINNUNCULUS ALAUDARIUS.—The Kestrel.

Blanford, No. 1265.

The Kestrel was, I think, the commonest hawk on the Nilgiris and bred freely on mostly inaccessible rocks. I, however, was fortunate enough to obtain a nest containing 4 eggs in March 1903.

TANARHAT P. O., A. M. PRIMROSE.
ASSAM, *July* 1904.

No. XVI.—*CASSIA OCCIDENTALIS.*

With reference to Mr. Fischer's remark in the last issue on *Cassia occidentalis*, I have also found in this district that the plant has only six perfect stamens.

The remark in Hooker about the petals must be a clerical error since it is the sepals which are lilac and conspicuously veined.

As regards the stamens, there appears to be a considerable variety. Roxburgh, II, 343, gives only eight stamens, of which only four would appear to be fertile. "The Flora of Bombay" (Cooke) and "Bengal Plants" (Prain) both, however, agree with Hooker.

ANANTAPUR, MADRAS PRESIDENCY, B. H. BARLOW-POOLE, I.F.S.
1*st August* 1904.

No. XVII.—NOTES ON THE NESTING OF SOME BIRDS IN THE UPPER CHINDWIN DISTRICT, BURMA.

No. 553.—THE SIAMESE MYNA (*Æ. GRANDIS*) AND No. 554.—THE COLLARED MYNA (*Æ. ALBICINCTUS*).

The distribution of these two mynas in Burma seems to be very well defined, both being common in the Shan States, again appearing in the Bhamo District, and from there across into the Myitkyina and Upper Chindwin Districts. They are essentially birds of a damp climate, preferring fairly open country with large expanses of "Kine" or Elephant grass. In the Upper Chindwin, *Æ. grandis* appears as low down as Mingin, and gets commoner the higher one goes up the river; whilst *Æ. albicinctus* does not appear until about 40 miles above Kindat, from there it is quite as plentiful as *Æ. grandis.*

Both seem to prefer nesting in colonies of their own species or along with other mynas of different kinds; and any old tree, and especially if it be a Ficus of sorts, will have all the available holes filled up with nests of these two mynas. This peculiarity of birds nesting together was very marked in a tree at Kindat, in which the following birds were found nesting in the month of May : the Siamese myna, common house-myna, white-winged myna, common pied-myna, red turtle-dove, Burmese red-vented bul-bul and king-crow ; and a month before from the same tree a friend of mine took eggs of the "Blue-Jay" and *Palæornis rosa* ; another tree at Thamanthi was inhabited by the Siamese, collared and grey-headed mynas and one nest of the lineated barbet. The holes taken up by the first three all seemed to have been made by barbets or wood-peckers ; one huge decayed branch which was unsafe to climb was full of mynas' nests, the birds going in and out like pigeons from a dovecote.

The strangest nesting site of *Æ. grandis* and *albicinctus* was finding their nests in holes along the banks of the river. The Chindwin above Kindat flows through fairly level country and has steep sandy banks forming ideal nesting places for sand-martins and the blue-tailed bee-eater which were nesting in thousands. While going up the river by launch we were surprised to see mynas in numbers flying in and out of holes in one bank. On getting out our glasses we found them to be of the above two kinds. This was in the latter half of May and was rather late, as the majority had hatched out or had hard-set eggs. A fortnight or so earlier one could have got eggs by the hat-full, as they were nesting in colonies after the manner of bee-eaters. Whether the holes were originally made by other birds and then enlarged by the mynas or dug out entirely by them would be hard to say, as in many cases the mynas were nesting in the same colony as the bee-eaters, but others I think must have been made solely by the mynas, as they ran from only one foot to two or three feet in depth. Both kinds of mynas were found nesting together, but generally managed to keep apart. All the nests were of the usual myna type—made of grass, rags, feathers, etc. The extraordinary thing about the nests was, however, that every nest we pulled out had pieces of snake skin, we must have examined some dozen nests or more and found it the rule without exception, so that it was not the weird fancy of a few birds, but the fashion or protective instinct of all.

The eggs are of the regular myna blue colour, the Siamese mynas as a rule laying rather long pointed eggs, and the Collared mynas slightly smaller and rounder ones, *Æ. grandis* laying in clutches of three to four, rarely two, and *Æ. albicinctus* generally four and very rarely five.

We also found *Æ. grandis* nesting in the roofs of houses and in Hpongi-choungs.

No. 1503.—THE RIVER TERN (*S. SEENA*) ; No. 1425.—THE LARGE SWALLOW-PLOVER (*G. ORIENTALIS*) ; No. 1427.—THE SMALL SWALLOW-PLOVER (*G. LACTEA*).

On the 30th May I went out to try and get a good supply of Siamese and Collared mynas' eggs, so dropped down river by country boat. Shortly after starting I saw a lot of Terns and Swallow-Plovers hovering over a sand-bank, and thinking that they might still be breeding I landed and extended my three men, and sure enough we found many nests of *S. seena* and *G. lactea* ; but the disappointing thing was that the birds seemed quite satisfied with one or two eggs, and not laying up to the authorised scale of three and four. Nearly all the eggs were hard-set, a large number of young birds were also about. I was fortunate finding four nests of the Large Swallow-Plover (*G. orientalis*). These again were quite content with one and two eggs, as two of the nests contained two incubated eggs each and the other two one each, also incubated. This last bird's eggs were very difficult to find, as they were laid on grassy mounds on the sand bank, whilst the Terns and Lesser Swallow-Plovers laid out on the bare sand. It was very interesting watching the strange antics the two kinds of swallow-plovers went through to entice one away from their eggs or young, while the Terns kept shrieking and swooping at our heads. We only took a few eggs of the first two kinds, but might as well have taken the lot, as two days after the river rose considerably, submerging all the sand-banks. It seems as if these birds go on nesting as long as they possibly can, as a friend of mine kindly got me eggs of *S. seena* and *G. lactea* in March last from sand-banks in the Upper Chindwin.

No. 22.—THE HOODED RACKED-TAILED MAGPIE (*C. CUCULLATA*): BURMESE NAME—NA-PA-JU.

This handsome little Magpie is well distributed over the dry zone of Upper Burma, being found in the Yamethin and Meiktila Districts and across into the Lower Chindwin and as far up as Mingin in the Upper Chindwin.

It seems to be very partial to what is known in Burma as "Themin jungle," a fairly open thorny scrub-jungle.

I was unfortunately laid up by an accident in April last and was unable to go out after the nests of this magpie. It was very aggravating, as I had marked down a tract of jungle where it seemed very fairly common. However, the Deputy Commissioner kindly came to my help promising to try and get some eggs brought in, so I gave him a skin of "Na-pa-ju," asking him to order nests to be brought in complete with *branches* and eggs. The necessary instructions were given, and resulted in two nests, with branches complete and some eggs, being brought in early last May. Both nests were exactly similar in make and description and were built in a thorny tree, and would, I imagine, be rather difficult to find, as they were very flimsily, but neatly, put together, light being seen through in all directions. The nests consist of two distinct parts, first a neat saucer-shaped structure of "wait-a-bit" thorns, very like the miniature inverted dome or upper covering to the nest of the Common Magpie (*P. rustica*), inside this was placed a small well-made nest of grass stems and creepers, the thorns coming up well over the sides of the nest, the whole idea of nest giving one the impression that the bird feared enemies from below and not from above. The dimensions of nests were—outer diameter of thorny structure about six to seven inches and about five inches deep, of nest proper diameter about three inches by one and a half inches deep.

Eggs measure about ·95 × ·7, and are coloured very like *D. frontalis*, a grey-stone ground colour with olive spots, some having a distinct zone. There can be no doubt as to the identity of the eggs, as *C. cucullata* is the only bird in the dry zone whose eggs remain unidentified. I have shewn both nests and eggs to K. C. Macdonald, describing locality and date, so I hope he will be fortunate enough next year to get a good series of eggs, as the bird is fairly common in certain tracts.

MONGWA, BURMA, H. H. HARRINGTON, CAPTAIN.
9th August 1904.

No. XVIII.—NOTES ON BURMESE REPTILES.

DRYOPHIS MYCTERIZANS.

In a paper on Burmese Snakes, Vol. XIII, page 615, Captain Wall and I mentioned a specimen containing three apparently mature young. I killed a female on 4th May containing five young, without trace of an egg envelope.

DRYOPHIS PRASINUS.

A specimen killed in jungle by a Burman, 5th June, contained nine (9) eggs.

This snake in the adult stage is described in Boulenger's Reptilia :—'Fauna British India'—Reptilia and Batrachia, as ferocious, while *Dryophis mycterizans* is said to be a very gentle snake. My experience is that both are gentle enough when left alone, but when irritated *Dryophis mycterizans* often loses his temper badly, and with open jaws strikes violently, raising the fore part of the body well off the ground in order to do so, while I have rarely found *prasinus* at all vicious, even when subjected to considerable irritation.

LYCODON FASCIATUS.

In Volume XIII, page 372, Captain Wall and I described two specimens of this apparently rare snake. I have been fortunate in obtaining a third from a friend who killed it at Maymyo, 3,000′.

Length 2′-7″
Tail 6½″
Anterior chin shields equal to posterior.
Ventrals 203.
Subcaudals 86.

Colour as already described ; there are 28 reddish yellow bands on body and 14 on the tail.

SIMOTES ALBOCINCTUS.

This is the first specimen I have received or seen in Burma. It was killed on the 6th April 1902 at Sadôn, Kachin Hills, 4,500′.

Length 2′-10″.
Tail 6″.
The internasal suture almost equals the præfrontal.
Loreal shield united with the præfrontal.
Ventrals 202.
Subcaudals 58.

There are in all 23 light, black-edged bands involving two scales, the intervals eight scales.

DIPSADOMORPHUS CYANEA.

This snake I consider is a very rare one in Burma. On the 1st instant I was fortunate in receiving a very fine female ; she was killed in a garden at Kokine some three miles from town.

Rostral just visible from above.
Loreal depth slightly less than length.
Temporals 2 + 4 R, 2 + 3 L.
Ventrals 247.
Subcaudals 124.
Length 4′-9″ ; tail, which was whip-like, 14″.

Colour above, a uniform dark, grass green ; under jaws bluish white turning to slight yellow at fifth ventral, after which the colour was more pronounced. The specimen was rather mutilated about the body. I found on opening up a wound into the abdominal cavity two eggs uninjured, two damaged. There may have been others which were destroyed.

The eggs measured 1·25″ × ·62″. There was no trace of an embryo ; the contents consisted of a thick creamy material of a pale yellow colour.

THE FOOD, ETC., OF CHRYSOPELEA ORNATA.

In Boulenger's Reptilia and Batrachia, page 372, it is stated that "it feeds almost exclusively on Geckos." I believe that Geckos do constitute a main feature in their bill of fare. It is clear, however, that they are not averse to an occasional change. On the 8th July 1900 Captain Wall and I received a specimen which contained a bat, *Taphozons longimanus.* Two specimens since sent to me each contained a bat, unfortunately too far digested for easy recognition. It is notable that these two specimens were killed about houses, that is on creepers over the trellis work of porches, where there is little doubt they found bats an easy prey. Another specimen I caught while it was lying on a bamboo contained a flying lizard, which I made out to be *Draco tæniopterus.*

With regard to the breeding of this snake. In a paper on Burmese Snakes, Vol. XIII, page 614, Captain Wall and I mentioned a specimen with two enlarged ovarian follicles received on 27th May 1900 ; again in same paper a specimen received on 26th June 1900 containing 9 eggs (5 in one ovary, 4 in the other).

Since this, specimens have been received by me ; one female on 3rd June 1904 containing 11 eggs (7 in one ovary, 4 in the other) : a brood of young (6) found by a Mali on 14th June which measured from 4½″ to 6″: in August two young specimens, from size perhaps 6 weeks old. One measured 13½″, tail 2⅝″; the other 14″, tail 3⅜″. In Vol. XIII, page 345, Captain Wall and I described the colour of a young specimen which differs from that of the adult, and I have observed that all the young specimens are as we then described.

Naia sputatrix.

One specimen, Southern Shan States—

Scales across hood	21
Scales midbody	17
Ventrals	170
Subcaudals	27, first 6 single.
Length	56″
Tail (docked)	6″

Colour a uniform deepish black with no marks of any description on hood or body. One fairly dark ventral band below the neck.

Ophisaurus gracilis.

I have on several occasions received specimens of this curious lizard, accompanied by letters of enquiry as to the nature of the peculiar 'snake' sent. In Boulenger's work, page 159, Rangoon is mentioned as a habitat. Though my residence here extends over a number of years, I have never seen nor heard of a specimen captured here. This might of course easily happen, but that a great variety of snakes, insects, etc., find their way to my bungalow. I am quite certain of one thing, however, and that is it is an extremely rare reptile here. The specimens received and those taken by myself were all at places of considerable elevation, *i.e.*, from 2,500′ to 5,000′. If I remember rightly, Mr. Hampton informed me it is by no means rare about Mogôk in the Ruby Mines district.

It may be interesting to note that on the 7th August 1903 a friend living at Maymyo 3,000′, while engaged in digging out stumps from his garden came across two of these lizards at the root of a stump some 15″ to 18″ underground, and while effecting their capture discovered eight eggs. The lizards and eggs were sent to me. The latter were of a dirty whitish brown colour tinged with red. Measurements varied a trifle, but they were about ·8″ × ·48″ and contained embryos measuring 2½″ in length.

The specimens were just as described in Boulenger's Reptilia: 'Fauna British India'—Reptilia and Batrachia.

G. H. EVANS, F.L.S., Major.

Rangoon, 10*th August* 1904.

No. XIX.—THE NIDIFICATION OF THE LITTLE BLUE WINGED PITTA *(PITTA CYANOPTERA)* IN UPPER BURMA.

On the 26th July 1904, while walking home along a path through light jungle, I flushed a Pitta close to the path (about 1½ yards). I soon detected a nest, so retired and took cover near by. After considerable waiting the bird returned, and I was able to recognise it. The nest was situated on a mound and only slightly hidden by some blades of long grass. The opening faced the path, which I fancy was one only occasionally used by odd persons visiting jungle. What struck me was the enormous size of the nest for a bird so small; it consisted of old bamboo and other twigs and a few leaves loosely laid about. The interior was neatly lined with fibre, and the entrance hole was just above the ground. There were five eggs, quite fresh. I ran a tape lightly over the rough structure, which measured 17″ across and 11″ from the upper part of entrance to back of nest. The entrance measured 3″ × 4″.

I took three eggs : they measured as follows:—

1″ × 0·85″. ·95″ × ·8″. 1″ × 0·85″

Colour as described in Vol. II, page 283, of Hume's 'Nests and Eggs,' 2nd edition, Oates.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 10*th August* 1904.

No. XX.—VEGETATION IN SIND.

(*Extract from an address entitled "The Province of Sind," by H. M. Birdwood, C.S.I., M.A., LL.D., late President of the Bombay Natural History Society, read before the Society of Arts, London, on* 23*rd April* 1903.)

Within the area watered by the canals all vegetation is luxuriant. Where the soil is deep and rich, as it is in most of the alluvial tracts, the cereal crops develop a growth unknown on used-up lands elsewhere. At Jacobabad, a body of spearmen, riding through a field of "Jowari," the great Indian millet (*Sorghum vulgare*), have been known to effectually screen themselves, horses, spears, and all, in the lofty shelter of the cornstalks. In the forest reserves near the Fuleli at Miani, the "Babul," or gum Arabic tree (*Acacia arabica*), and the "Kandi" (*Prosopis spicigera*), the two commonest forest trees of Sind, attain a height and girth beyond anything seen in Guzerat, the garden of India, or the Deccan, where the Babul is very much "At Home." In the Collector's garden at Larkhana there is a splendid *Ailanthus excelsa*, excelling in size and vigour of stem, branches, and its great pinnate leaves, any of the fine trees in the grove so well known to travellers at one of the villages on the road from Wattar to Mahableshwar. The "Tali," or Blackwood (*Dalbgia latifolia*), also thrives in Upper Sind, but not so luxuriantly as in the neighbourhood of Agra. At Shikarpur, the magnificent avenue of "Sirras" trees (*Albizzia lebbek*)—an entirely modern growth of British times—gives a most grateful shelter from the hot son of March or April ; nor can I soon forget the plantation of Chinese Tallow-trees (*Sapium sebiferum*) near the little English cemetery at Sehwan, below the massive mud fort on the Indus, which, some say, was built by Alexander, and some, by Shem, the son of Noah—with what authority, in either case, no one can perhaps say. I have grown these shapely trees, which, in general contour and size, are comparable to the Birch, on the red soil of Malabar Hill in Bombay and on the sandy soil of the University Garden on the Esplanade, and successfully ; but they have never displayed there the rich sunset-tints, purple and crimson and gold, with which they glorify the landscape in the crisp, chilly evenings of the late autumn in Sind. Nor will any Sindhi be slow to pay his tribute to the pervading grace of the endless self-sown tamarisk thickets of every landscape in Sind of which any stream or pool of water forms a part. In his carefully prepared "List of Trees, Shrubs, &c.," of the Jerruck division, Mr. G. K. Betham includes three species of tamarisk, one of which, the "Asri" (*Tamarix articulata*) is a tree of fair size. In some parts of Sind the tamarisk jungle gives cover to vast numbers of wild pig.

Beyond the reach of the silt-laden waters the dry and hardened ground is almost bare, and in such places the physical contrast is most striking between the landscapes of Sind and the hilly tracts of some other parts of the Bombay Presidency. My recollection of particular plants is not recent, but I have refreshed my memory from a paper I wrote only a few years after I had left Sind, and I then noted that where there was any vegetation at all the characteristic plants, in places beyond the influence of the river and the canals, were those of the desert—the "Kirar" or leafless Caper (*Capparis aphylla*)—essentially a lonely plant, but beautiful, with its countless brick-red flowers,—the "Pilu" (*Salvadora persica*) with fleshy leaves, and strings of translucent, rounded, glutinous fruit, shining like pearls—and the *Parkinsonia aculeata*, with clear, yellow, crumpled flowers, freckled with brown, and spiny branchlets, which once suggested to a great Italian painter his idea of "the Crown of Thorns." Then there is an undergrowth of Camel-thorn (*Alhagi camelorum*), which, near Kandahar and Herat, yields manna "at flowering time, after the spring rains," and is an agreeable food for camels and useful for door-tatties in the hot weather;* and of various plants of the Goosefoot tribe (*Chenopodiaceæ*), one of which, the *Sueda maritima*, yields, according to Mr. Betham, "an impure carbonate of soda, used in soap-making, calico-dyeing and washing," and is also a favourite food of the camel. And there is that curious plant, the "Panirio" (*Withania coagulans*), of the potato tribe, whose juice curdles milk into "panir" or cheese. In these arid tracts, with such strange herbage, the traveller misses the fresh, bright tints which enliven the forests of the Konkan and the western Ghâts in the early spring of March or in the second spring of the early weeks of June. The prevailing tones are sad, secondary, bluish-greens, and the same faint colours repeat themselves everywhere on uncultivated lands, and are only rarely relieved by the deep, glossy greens of the Salvadora. There is nothing like it in the rest of the Presidency, except in the districts nearest Sind. It is to the Flora of Africa that the indigenous vegetation of Sind is most closely allied.

No. XXI.—THE RUSSELL'S VIPER.

On the 14th February last, whilst encamped in the Dantra district of the Máhi Kánthá, I killed a Daboia (*Vipera russellii*) of such an unusually large size that perhaps it may be considered worthy of record in our Journal.

One of my servants, on rising from his midday sleep, noticed the quite fresh trail of a large snake so near to the spot where he had been lying that it must almost have touched him. On drawing the notice of my butler to the trail which could not be mistaken in the deep soil, the latter followed it across the field to an old *Umra* tree, near my tent, where he discovered the snake lying, coiled up, amongst the roots. On hearing him call out " Samp " I rushed out with a gun and killed the reptile. On drawing it out and measuring it, it turned out to be a Daboia no less than 5′-4½″ in length.

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* Dr. Dietrich Brandis' "Forest Flora of North-West and Central India," p. 145.

I have killed a good many of these snakes at different times, but this one was by far the largest I have ever come across.

On examining the mango tree under which my man had been sleeping I discovered a hole in it at the very base of the trunk, for which the snake had evidently been making when its path was blocked, for a few days later the same man saw another snake—probably the mate—peeping out of the same hole. Unfortunately I arrived too late to despatch it, too.

In the Dantra district the Daboia is known as the " Khăd chitra "—" *Khad* " being the Guzerati for grass and " *chitra* " *may* stand (?) for " cheetah, " the ordinary term (with " *dipdo* "—" the spotted one ") in these parts for the panther, but of this I am not *quite* sure. In the *Konkani* districts of Sávánt Vádi, where a large number of deaths are annually put down to the bite of this snake, it is known as the " *Ghánas*." I find the same name is applied here in Kashmir to a snake which the natives tell me is very venomous. This cannot, I think, also be the *Daboia* of India, but so far I have not seen a specimen although the snake is said to be fairly common.

L. L. FENTON, LIEUT.-COLONEL, I.A.

KASHMIR, *September* 1904.

The specimen above recorded by Colonel Fenton was undoubtedly a very large one, but in this Journal, Vol. VIII (page 565), Mr. F. G. Brook-Fox stated that he had killed two which measured 5′-6″ each. The largest specimen in our collection was obtained by Mr. J. C. Anderson, at Hurda, C. P. and measured 5′-2″.

According to the standard authority, *Fauna of British India Reptiles,* by G. A Boulenger, the Daboia (*Vipera russellii*) is found in Kashmir up to 6,000 feet.

EDITOR.

No. XXII.—A COBRA FEEDING ON EGGS.

A cobra attacked, at 10 a.m. the other day, the nest of a Guinea-fowl sitting in my compound, and as none of the servants would kill it my wife sent for me. I arrived about 40 minutes afterwards, and found the cobra coiled up within 24 inches of the nest and the Guinea-fowl still sitting. I shot the cobra and pressed two eggs out of the dead body, one of these eggs hatching. The curious thing was that the Guinea-fowl was still sitting on her nest within a couple of feet of the cobra after it had taken two eggs and that one of the eggs should have hatched after having been inside the snake for from 30 to 40 minutes.

C. P. GEORGE.

SECUNDERABAD, 13*th September* 1904.

No. XXIII.—BEE-CULTURE IN INDIA.

With reference to Mr. Phipson's remarks, at the last meeting of the Society, on the subject of Bee culture in India, the following notes may be of interest. There are in India, so far as is known, only three species of the true honey-bee (Apis), *viz.*, *A. dorsata*, *A. indica*, and *A. florea*. A number of other forms have been described, but these all appear to be varieties of the above three species. *A. indica* is closely allied to *A. mellifica*, the European honey-bee, and only differs slightly in colour and size, being smaller and darker.

A. dorsata is a large and very fierce species, frequently dangerous in the jungle when irritated, and I am not aware that attempts have ever been made to domesticate it. Mr. David Hooper, in a recent number of the "Agricultural Ledger," gives the following reasons against any attempt to cultivate this species as a hive bee :—

"(1) The bee builds naturally in the open.

"(2) It builds normally only one comb, so that the honey cannot be removed without removing the brood also.

"(3) Although the comb is very large, it is not so great in cubic capacity as the combs built by *A. mellifica*, which is readily cultivated, and the habits of which are well understood.

"(4) It is only found in a tropical climate."

The first three seem to me to be valid reasons enough ; the last is not strictly correct, as *A. dorsata* is common at Simla, where the winter is very severe, and probably also in other parts of the Himalayas.

A. indica is more or less domesticated and cultivated in Assam, most districts of the Himalayas, the Kuram Valley, and Kashmir. Its habits are similar to those of the European *A. mellifica*. Experiments have been made, probably with this species, in some of the Bombay hill stations, but, according to Mr. Hooper, with no very signal success.

A. florea is a small species ; the comb is usually built on a small tree or bush (at Deesa I nearly always saw them in thorny bushes) ; this species is common throughout India, but would scarcely repay domestication, and the reasons against its cultivation would appear to be the same as those against that of *A. dorsata*.

I scarcely understand Mr. Phipson's remark about "non-migratory" species ; I have never heard that any species of bee are migratory. The *Apis nigrocinctus* mentioned by him is *A. indica* under another name.

Besides the above, several species of *Melipona* (Trigona) produce honey and wax in commercial quantities, but as the species of this genus are very small, no attempt has, I believe, been made to domesticate them. They are stingless, or, at any rate, have no appreciable sting.

Apiculture is a profitable business if carried out on a sufficiently large scale by one who really understands it. A few years ago I came across a man whose brother was engaged in it exclusively in one of the Australian colonies and who was doing very well. He told me the number of hives kept by his brother, and the quantities of honey and wax exported by him, and they appeared to be enormous, so he must have been working on a very large scale. I gathered that the Australian Government gave some sort of bounty on the amount exported.

I have an idea that an attempt was made some time ago to introduce *A. mellifica* into the Nilgiris, but I do not know with what success. I see no reason why bee-keeping should not succeed in India, and I should think that there are possibilities in front of it. The greater part of the wax exported from India is at present obtained from wild bees.

C. G. NURSE, Major,
113th Infantry.

BOMBAY, *October* 1904.

BOMBAY, 24*th October* 1904.

No. XXIV.—ASSAM BIRDS.

I should be glad to know if *Gecinus striolatus*, the Lesser Indian Green Woodpecker, is at all a common bird in Assam. It seems to be here as my collector has already brought in two males, this, after my having shown him specimens of the bird from S. India, he declares it is very common, he also tells me, on having seen specimens of *Megalæna marshallorum* The Great Indian Barbet and *Cyarops franklini*, that both birds are procurable here in February, but I very much doubt this. I may mention that both the Black Partridge and the Bengal Floriken are common birds here. I am told that a former manager used not unfrequently to shoot as many as four and six of the latter in a morning and this without much trouble.

A. M. PRIMROSE.

MORNAI TEA ESTATE, TAMARHAT P. O.,
GAURIPUR, ASSAM,
October 1904.

No. XXV.—BREEDING SEASONS OF BIG GAME.

If I remember rightly—for I am writing under circumstances that prevent my refreshing my memory—I alluded on one occasion in the Society's Journal to the limited field for original observations by naturalists amongst the larger, compared with the smaller, mammals, in view of the fact that the former attracted so much more attention both by their size and by the fact that many of them were closely studied by sportsmen. Although this is perfectly true from a comparative point of view, there is a great deal that we have yet to learn regarding the habits and life-history of big game, more especially in connection with their breeding seasons. I therefore take the opportunity of directing the attention of our members to the following important note that appeared over the well-known initials "R. L." in the *Field* of 3rd September 1904.

"In the course of his Presidential Address to the zoological section at the recent Cambridge meeting of the British Association, Mr. Bateson took occasion to emphasize the supreme importance of a thorough investigation of all the phenomena connected with the breeding of animals as affording the chief clue which is likely to explain the complex problems of heredity and evolution. He compared, indeed, the breeding-pen in its importance to zoology to the test-tube in chemistry, and remarked that every variation from type is due to a pathological peculiarity. Although these remarks referred in the main to the case of domesticated animals, or of wild animals kept in captivity, it is manifest that, from the standpoint of the evolutionist, it is of scarcely less importance that we should possess accurate and trustworthy information with regard to the variation produced in the breeding seasons of wild animals by climate, station, and environment generally. For it is quite evident that if a species breeds in one district at a certain time of the year, and some months earlier or later in a second district, we have, *ipso facto,* a pronounced element in favour of variation in its offspring, and thus a valid cause for the eventual production of a new variety or species. As a well-known investigator of this subject has recently pointed out to me, our knowledge of the breeding seasons of big game in general is in an exceedingly unsatisfactory and crude condition; so imperfect, indeed, as to be practically useless for the purposes of exact study. Take, for instance, such well-known works as Blanford's *Mammals of India* and the *Great and Small Game of Africa,* published by Rowland Ward, and edited by Mr. Bryden, and the unsatisfactory state of our information on this subject will be at once apparent. In the former work, for instance, we find the oft-repeated statement that the breeding time of a particular species is "about" such and such a month; while in the case of such a well-known animal as the Himalayan serow we find the statement that whereas, according to Hodgson, a single young one is born in September or October, Adams gives the spring as the time when the fawns come into the world. Such statements (though no fault, be it observed, on the part of the author of the invaluable works in question) are, of course, absolutely useless for any generalisations with regard to the breeding seasons of groups of animals. Take, again, the case of the sambar deer, in which, as stated in Mr. Blanford's volume, doubt still prevails with regard to the dates of the breeding season and of the shedding of the antlers, both of which are evidently correlated. In peninsular India, for instance, the stags are said to rut in October and November, but in the Himalayas not till the spring, whereas the antlers are reported to be usually dropped in March in the one area and in April in the other. Obviously there is something wrong in this. In addition there is the well ascertained fact that some stags do not shed their antlers at the usual time, while some are stated to retain them for more than one season. The probability would seem to be that in the plains the sambar has two breeding seasons, and that stags born at one season shed their antlers and breed at a different time of year from those which are produced at the opposite season. All this requires, however, to be ascertained by careful and accurate observation on animals in the wild state, for those kept in a state of captivity cannot be relied upon to afford trustworthy data on such a matter.

" As regards the large game of Africa, our information with regard to their seasons of breeding is much more defective than is the case with those of India; and in the work on African big game already cited, which, be it noted, has been written almost entirely by sportsmen practically acquainted with the animals they describe in their native haunts, it is really surpsising how very little definite information is supplied on the subject in question. In the case of some species nothing at all is said, while in that of well-known forms with a wide geographical range, such as the kudu, the date of the breeding season is given in one or, perhaps, two districts. Such information is practically valueless in the case of an antelope whose range extends from Cape Colony in the south to Somaliland on the east and to Angola on the west coast; and what we want to know are the dates of the breeding season in these widely-sundered areas as well as in the intervening districts. As to the period of gestation in the big game animals of Africa, little or nothing seems to have been recorded. Sportsmen are unlikely to be able to supply the information required with regard to the latter subject, which will probably have to be obtained from animals kept in captivity. They have, however, unique opportunities for acquiring trustworthy data with regard to the breeding seasons of the various species that may come under their notice, and when the interest and importance attaching to information of this nature become generally known, I have strong hopes that British sportsmen will not be behindhand in endeavouring to supply what is wanted in this matter. The columns of the *Field* will, I feel sure, be always open to letters containing definite and exact information on this subject, while it is probable that lists of the dates of the breeding seasons of a number of species would be accepted for publication by the editors of some of our zoological journals.

" For further information with regard to the periods of gestation of the larger herbivorous mammals we must look, at all events in the main, to the officials of zoological gardens and menageries, and, above all, to the owners of private collections in parks both in this country and in Africa, where the animals live under conditions more like those of their native homes than is the case in ordinary menageries."

This so ably points out the directions in which our investigations should be pursued and the weak points in our knowledge of the life-history of big game that I feel there is little that I need add to the appeal. Many of our members have almost unique opportunities of gathering the information required, and I would emphasize the point that it is only by the accumulation of authentic notes from all parts of the country that reliable conclusions can be arrived at. As the protection of game has lately engaged the attention of the Government of India with a view to legislation appointing close seasons, further information regarding breeding seasons will afford useful data for the effective carrying out of this object, which every sportsman must have at heart.

There is often a certain reluctance amongst many of those who can collect and supply the information to take the trouble to put their observations into proper shape for publication, but I would urge all those who may be deterred by this or other reasons to let us have *any* " definite and exact information on this subject," however rough it may appear, for even if it is not in the form of a note for publication by itself, it will, however meagre, so long as it is definite and exact, help towards the accumulation of records from which most valuable information can be deducted when all are tabulated and compared.

E. COMBER, F Z.S.

BURRINGTON, SOMERSET, 12*th September* 1904.

No. XXVI.—ALBINISM IN A SHRIKE.

A few days ago Mr. P. F. Campbell, Assistant Manager in the Holta Tea Company, Kangra Valley, told me he had seen a pure white Shrike on the plantation which he had left a man to mark while he returned for his gun. He then went after it and shot it. The bird, which I skinned and preserved, is pure white, with the exception of a faint irroration of grey on the outer webs of the posterior primary wing feathers and of the two outer tail feathers on the right side, also both webs of the secondary and tertiary wing feathers, the latter being tipped with very faint rufous. The irides were dark brown and the bill and legs *flesh colour*. The rictal bristles, of which there are 7 on one side and 6 on the other, are strongly developed and white. The following are measurements taken from the skin:—Length 9·2″, tail 4·5″; wing 3·5″; tarsus 1·1″; bill from gape ·9″.

Owing to there being no markings by which to distinguish this specimen, I have concluded that it is an albinism of *Lanius tephronotus,* a common bird here—in fact the only Shrike which I have seen within a couple of miles radius. It is evidently a young bird, as many of the feathers of the back and rump are not completely developed. The preserved skin is in the possession of Mr. Campbell, who, I have no doubt, would send it to the Society for examination if requested to do so.

G. C. DUDGEON, F.E.S.

PALAMPUR, PUNJAB, 20*th September* 1904.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 16TH JUNE 1904.

A meeting of the members took place at the Society's Rooms, on Thursday, 16th June 1904, Mr. James MacDonald presiding.

NEW MEMBERS.

The election of the following new members since the last meeting was duly announced :—

Mr. C. E. Allen, I.F.S. (Tharrawaddy, Lower Burma); Mr. F. Walter (Rangoon); Lieut. H. S. Eliot, R.A. (Quetta); Mr. C. F. Grant, I.C.S. (Rangoon); Mr. W. H. B. Salmon (Bolarum); Mr. J. R. Huggins (Koraput); Mr. R. H. Ellis, I.C.S. (Chittor, N. Arcot); Mr. H. Fearon (Coconada); Lieut. R. J. B. Yates (Jubbulpore); Lieut. G. H. E. Twemlow (Wellington); Capt. E. E. Beddek (Cannanore); Capt. G. Clarke (Cannanore); Mr. N. A. Worlledge (Cannanore); Dr. G. F. Goldsmith (Lashio, N. Shan States); Mr. W. A. Knyvett (Gaya, Bengal); Major F. W. G. Wadeson (Fort Sandeman); Dr. E. H. Hunt (Secunderabad); Mr. F. A. Möller (Darjeeling); Mr. G. A. Miller (Darjeeling); Major C. H. Hale, R.A.M.C. (Rangoon); Capt. H. N. Baker (Singapore); Mr. E. Hicks (Tezpur, Assam); Major F. de B. Young (Poona); The Secretary, American Museum of Natural History (New York) and Mrs. A. C. Hearsey (Ranikhet).

The Honorary Secretary drew the attention of those present to the fact that out of the above 25 new members none were residents of Bombay and very few belonged to the Presidency. It constituted good evidence that the Journal of the Society was being read and appreciated in distant parts of the country.

CONTRIBUTIONS TO THE LIBRARY.

Faune Entomologique de L'Afrique tropicale.

Descriptions of new species of Aculeate and Parasitic Hymenoptera from Northern India, by P. Cameron. From the Author.

Descriptions of new Genera and species of Hymenoptera from India, by P. Cameron. From the Author.

Description of a new species of "quartinia" from Deesa, India, etc., by P. Cameron. From the Author.

Description of a new species of "Athalia" (*Tenthredinidæ*) from India, by P. Cameron. From the Author.

Memoires de la Sociéte Zologique de France. Tome XV.

Blood Immunity and Blood Relationship, by Dr. G. H. F. Nuttall, F.R.S. From the Author.

The Transactions of the Entomological Society of London, 1903. In exchange.

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's Collections :—

Contribution.	Description.	Contributor.
1 Malabar Whistling Thrush (alive).	*Myiophoneus horsfieldi*	Mr. R. C. H. Barnard.
1 Skin of Palm Civet	*Paradoxurus nictitans*	Mr. D. A. MacMillan.
1 Chameleon	*Chamaeleon calcaratus*	Mr. P. Gerhardt.
1 Monitor	*Varanus salvator*	Mr. E. L Barton.
1 White-tailed Bush Chat	*Pratincola leucura*	Mr. S. L. Whymper.
2 Austen's Babbler	*Drymocataphus assamensis*	Dr. H. Coltart.
2 Red-throated Tit-Babblers.	*Schœniparus rufigularis*	Do.
2 Short-wings	*Brachypteryx sinensis*	Do.
1 Close-barred Sand Grouse	*Pterocles lichtensteini*	Major H. A. F. Magrath.
1 Himalayan Viper (alive).	*Ancistrodon himalayanus*	Mr. C. Vernon Purkis.
A quantity of Marine shells from Aden.	......	Mrs. Cabral.
1 Skin of the large Brown Flying-Squirrel.	*Pteromys oral*	Major A. F. Pinhey, C.I.E.
1 Snake	*Lycodon aulicus*	Major C. Hudson, I.M.S
Some land shells, &c. from Assam.	....	Mr. James Marten.
Boar's Tusks, 9¾in.	....	Mr W. Kirkpatrick.
1 Snake	*Chrysopelea ornata*	Mr. W. Sparke.
1 Flying Lizard	*Draco maculatus*	Do.
1 Snake	*Dipsas trigonata*	Mr. A. T. Whittle.
A collection of 187 Birds' Skins from Chitral	....	Capt. G. A. Ferreau.
1 Cinereons Vulture (alive).	*Vultur monachus*	Major T. E. Marshall, R.A.
A collection of Birds' Eggs from Quetta.	89 *Eggs of 33 Species of Birds.*	Do.
4 Rats from Kashmir	*Mus vicerex* sp. n	Col. A. E. Ward.
1 Red-crested Pochard	*Netta rufina*	Mr. R. H. Heath, C.E.
1 White-eyed Duck	*Nyroca ferruginea*	Do.
2 Black-bellied Sandgrouse	*Pterocles arenarius*	Do.
3 Common Sandgrouse	*Pteroclurus exustus*	Do.
2 Spotted Sandgrouse	*Pteroclurus senegallus*	Do.
1 Snake and Eggs (showing that this Viper is oviparous).	*Lachesis monticola*	Mr. G. A. Miller.
1 Snake (alive)	*Zamenis mucosus*	Mr T. J. Tomkin.
6 Eggs of Common Flamingo from the Runn of Cutch.	*Phœnicopterus roseus*	H. H. the Rao Saheb of Cutch.
1 Screech Owl	*Strix flammea*	Mr. P. Fischer.
1 Slow Loris and young	*Nycticebus tardigradus*	Capt. W. H. Lane.

PAPERS READ.

The following papers were then read and discussed :—

1. Plants introduced into the Victoria Gardens, Bombay, since 1896, by C.D. Mahaluxmivala ; 2. The Wild Plantain, by G. M. Ryan, I.F.S. ; 3. Notes on the Flora of Northern Ganjam, by Cecil E. C. Fischer, I.F.S. ; 4. The Birds of Chitral, by Capt. H. T. Fulton, D.S.O. ; 5. Natural Checks on Over-increase, by Major A. Newnham ; 6. Fly-fishing in the Bombay Presidency (*Megalops cyprinoides*, a fly-taker), by W. A. Wallinger ; 7. Melanism amongst Panthers,

by T. A. Hauxwell, I.F.S.; 8. The Indian Edible-nest Swiftlets (*Collocalia fuciphaga*) in the Pulney Hills, by R. Foulkes; 9. Some notes on Butterflies and Moths, by L. C. H. Young, B.A.; 10. Two notorious Insect Pests, by R. S. Hole, I.F.S.

PROCEEDINGS

OF THE MEETING HELD ON 18TH AUGUST 1904.

A meeting of the members took place at the Society's rooms, on Thursday, 18th August 1904, Rev. F. Dreckmann, S.J., presiding.

NEW MEMBERS.

The election of the following new members since the last meeting was duly announced :—

Capt. A. E. Hamerton, R.A.M.C. (Ferozepore); Dr. A. F. G. Kerr (Chiengmai, Siam); Mr. W. T. Page, F.Z.S. (London); Mr. W. N. Edwards (Majulieghur, Sootea P. O., Darrang, Assam); Mr. J. D. Stuart (Minbu, Burma); Mr. E. Steiner (Bombay); Mr. M. G. Sykes, I.C.S. (Cuddalore, Madras Presidency); Mr. G. A. D. Stuart (Nellore); Mr. H. Calder (Rangoon); Mr. Felix L. Dames (Berlin, Germany); H.H. the Rajah of Dhar (Dhar, C.I.); Mr. T. Moore (Russellkonda, Ganjam District); Major J. W. L. Elgee (Bangalore); Mr. C. Lucas (Bombay); Mr. Norman A. Macleod (Jaffirbund, Lalla P. O.); Capt. J. H. Dickson (Quetta); Lieut. A. G. Lyell (Lansdowne); Lieut. H. W. Long, R.A.M.C. (Jullundur); Mr. S. A. Wood, I.F.S. (Loilem, S. Shan States); The Professor of Zoology, Madras Christian College (Madras); Mr. F. W. Chanter, C.E. (Bombay); Major L. P. Chapman, R.E. (Bombay); Mr. Cassamali Jairajbhoy Peerbhoy (Bombay); Mr. C. H. Stowell (Grant Road, Bombay); Mr. W. W. Bulkley (Jeypore); Mr. G. Marjoribanks, I.F.S. (Belgaum), Col. F. W. Trevor, R.A.M.C. (Bombay); Mr. A. S. Lawrie (Russellkonda, Ganjam District); Mr. M. Crampton (Russellkonda, Ganjam District); and Mr. R. C. C. Carr, I.C S. (Chittoor, N. Arcot District).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's collections :—

Contribution.	Description.	Contributor.
A collection of named moths from Darjeeling.	......	Mr. G. A. Miller.
1 Indian Sloth Bear (alive).	*Melursus ursinus*	Mr. H. P. Le Mesurier.
2 Tiger Cubs (alive.)	*Felis tigris*	Major F. W. C. Jones, R.A.M.C.
A collection of Fresh Water Fishes from Lucknow.	......	Major A. T. Newnham, F.Z.S.
1 Changeable Hawk-Eagle.	*Spizætus limnætus*	Mr. H. H. Clutterbuch, I.F.S.
1 Bonelli's Eagle	*Hierætus fasciatus*	Do.
A collection of Spiders from Ganjam	......	Mr. C. E. C. Fischer, I.F.S.
1 Scaly Ant-eater (alive)	*Manis pentadactyla*	Mr. J. Black.
Eggs of the Upland Pipit	*Oreocorys sylvanus*	Mr. F. Field.

Contribution.	Description.	Contribution.
A Clutch of Eggs of the White-crested Kalij Pheasant.	*Gennæus albicristatus*	Mr. F. Field.
1 Snake	*Gongylophis conicus*	Capt. J. S. Oxley, I.M.S.
4 Cobras (alive)	*Naia tripudians*	Col. W. B. Bannerman, I.M.S.
17 Phoorsas (alive)............	*Echis carinata*....................	Do.
1 Ground Snake	*Eryx johnii*	Major H. D. Merewether.
1 Snake............................	*Tropidonotus plumbicolor*...	Mr. D. A. MacMillan.
4 Mouse-Hares *sp.n*............	*Ochotona wardi sp. n.*	Col. A. E. Ward.
Some Lepidoptera from Quetta District.	......	Mr. Neville Eliot, R.A.
3 Chukor Partridges from Arabia (alive).	*Cacabis chucar*.....................	Major F. V. Whittal.
14 Growing Cocos de Mer nuts from Seychelles.	*Lodoicea Sechellarum*.........	Monsr. R. Dupont.
1 Malay Bittern	*Gorsachius melanolophus* ...	Mr. J. B. Russell.

Minor Contributions.—Mr. F. Napier, Capt. G. M. Morris, Mr. J. W. Watson, and Mr. Bapu W. Telang.

The following contribution to the library has been made :—The Manual of Plague, by Major W. E. Jennings, M.D., I.M.S. By the Author.

PROPOSED PUBLIC MUSEUM.

The correspondence between the Proposed Museum Committee and the Bombay Natural History Society was placed before the meeting, and the following extract shows the opinion of the committee on the subject :—

" We are strongly of opinion that the Government of Bombay should possess a Scientific Museum in this city, and that a trained staff should be engaged from Europe with the object of carrying on research in every branch of Natural History, commencing with those which have a conspicuous economic value, but we think it would be worse than a mistake to undertake the formation of such an institution unless ample funds for endowment as well as for building are provided.

" A museum as a mere exhibition of natural history specimens is, in our opinion, of very little value, but as the head-quarters of a scientific staff, engaged in research, and containing working collections from which knowledge may be obtained, it then becomes an institution of enormous value to the State. For instance, it is obvious that, as a Maritime people, we ought before this to have done something to improve the coast fisheries of India, but nothing practical can be done in this direction until we possess a more complete knowledge of the marine fauna. At present we know nothing of the migration of sea fishes, or the periods and places at which they breed, and such knowledge can only be obtained by means of systematic collections made by trained naturalists.

" To possess such a museum, therefore, it is necessary to consider what will be the working expenses of the scientific staff as well as the probable cost of a building to contain collections and laboratories.

"The Government of Bombay state in the resolution that they can see their way to 2½ lakhs towards the erection of a museum, but they do not say that they are prepared to meet the heavy recurrent expenditure which would be necessary to provide for the requirements of a scientific museum staff. To ascertain what these expenses would amount to we can only refer you to the report of the Calcutta Museum for 1902, in which the working expenses considerably exceeded half a lakh per annum, irrespective of the gazetted salaries.

"The erection of a building that would be suitable for a museum, as well as a public library (*see* Government Resolution) on a conspicuous site in Bombay would cost, we should think, three or four times the amount mentioned in the resolution.

"The Bombay Natural History Society, which consists of about 900 members throughout India, Burma, and Ceylon, possesses very valuable collections gathered from the whole of the Oriental region, but they are essentially working collections and are not suitable for public exhibition, the object of the Society being in the direction of research rather than display, as is shown by the character of its publications.

"We note that it is intended to restrict the collections in the proposed museum to the area of the Bombay Presidency, but if it is the intention of the Government to undertake scientific research in all branches of local natural history, this Society will be in a position to render material assistance, and will, we need hardly say, be willing to do so."

A PRINCELY OFFER.

The Honorary Secretary stated that His Highness the Rao Saheb of Cutch had offered to subscribe Rs. 1,000 a year, for three years, to this Society, if it could see its way to engage an expert from Europe to make a marine zoological survey of the Bombay Coast, including the Gulf of Cambay and the Runn of Cutch. The cost of such an undertaking would, it was thought, amount to about Rs. 22,000, or, say, Rs. 7,500 a year, for a period of three years, and the task was consequently beyond the powers of this Society unless generous support such as that offered by H. H. the Rao of Cutch, were forthcoming from others. The Committee of the Society had already addressed letters pointing out the advantages of such a survey to all the States which possess a sea frontier on the Kathiawar and Konkan Coasts.

GOVERNMENT GRANT.

The Honorary Secretary stated that the Government of Bombay had made a grant of Rs. 2,500 to the Society for the present year, and that they had been good enough to promise to continue the grant (provided funds were available) so long as the Society continued to publish the results of its investigations and researches on subjects of public utility.

A vote of thanks was passed to the Government of Bombay for its assistance.

COLOURED PLATES.

The Honorary Secretary stated that orders for the following Coloured Plates, for the Society's Journal, had been placed in the hands of their London Chromo Lithographers :—8 Plates of Ducks; 1 Plate of Moths ; 4 Plates of Snakes ; 4 Plates of Orchids ; and 3 Plates of Cuckoo's Eggs—total 20 Plates.

The cost of these Coloured Plates would be about Rs. 350 each (or Rs. 7,000 in all), so that it was most important that the Society should obtain as many new members as possible in order to provide the funds for these useful illustrations.

PAPERS READ.

The following papers were then read and discussed :—1. Sexual Colour-dimorphism in Birds, by D. Dewar, I.C.S. ; 2. The Ancestry of the Horse by L. C. H. Young, B.A. ; 3. New Species of Indian Hymenoptera, by Major C. G. Nurse, F.E.S. ; 4. The Enemies of Butterflies, by E. H. Aitken ; 5. The Himalayan Nutcracker, by Col. W. Capper, D.M.E. in India ; 6. The Asiatic Two-horned Rhinoceros, by Major G. H. Evans, A.V.D., F.L.S.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 29TH SEPTEMBER 1904.

A meeting of the members took place at the Society's rooms, on Thursday, the 29th September 1904, Mr. L. C. H. Young presiding.

NEW MEMBERS.

The election of the following new members since the last meeting was duly announced :—

Mrs. M. Deakin (Bombay) ; Captain V. G. Drake-Brockman, I.M.S. (Bharatpur) ; Mr. F. H. Abbott, Secretary, Agri-Horticultural Society of India (Calcutta) ; Lieutenant J. C. McKenna (Myitkyina, Upper Burma) ; Lieutenant H. D. S. Keighley (Myitkyina, Upper Burma) ; Mr. C. C. Reid, I.C.S. (Calcutta) ; Mr. G. H. Belcham (Ratnagiri) ; Lieutenant J. L. Tweedie (Lucknow) ; Mr. A. L. Godden (Silchar, Cachar) ; Mr. H. R. Hume, D.S.P (Kaira) ; Mr. R. A. Wilson, I.C.S. (Nagpur, C. P.) ; Captain H. K. Colston (Mhow, C. I.) ; Lieutenant A. C. Cameron (Mhow, C. I.) ; Mr. F. G. Arnould (Kawant, Rajputana) ; Mr. Mahomedbhoy Currimbhoy Ebrahim (Bombay) ; Mr. J. O'B. Donaghey (Bangalore) ; Mr. C. C. Boyd, I.C.S. (Karwar) ; Mr. George Service (Bombay) ; Lieutenant F. H. Humphrys (Lahore) ; and Mr. R. K. Dadachanji (Bombay).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's collection :—

Contribution.	Description.	Contributor.
A collection of Moths and Butterflies from the Himalayas.	....	Mr. G. C. Dudgeon, F.E.S.

Contribution.	Description.	Contributor.
A Lizard from Baluchistan...	*Agama isolepis*	Col. R. H. Light.
2 Cobras (alive)................	*Naia tripudians*	Col. W. Bannerman, I.M.S.
1 Snake	*Simotes albocinctus*...........	Do.
1 Snake (alive).................	*Zamenis fasciolatus*	Do.
1 Monitor (alive)...............	*Varanus Bengalensis*	Dr. V. L. Mankar.
1 Bat	*Cynopterus marginatus*	Mr. C. G. Fee.
2 Terapins	*Platysterrum megacephalum* (from Siam)	Mr. H. D. G. Garrett.
Some Insects and Spiders ...	....	Mr. C. E. C. Fischer, I.F.S.
Butterflies	From Quetta......................	Mr. Neville Eliot, R.A.
1 Snake (alive)..................	*Python molurus*	Mr. D. J. Tata.
1 Snake..........................	*Oligodon McDougalli sp.n.*...	Mr. E. McDougall.

Minor contribution from Mrs. Payne.

Contributions to the Library:—Annals of the Royal Botanic Gardens, Calcutta, Vol. X, Part I, in exchange.

Catalogue of Birds in the British Museum, Parts XVI to XXV, from the Trustees.

BEE CULTURE.

Mr. H. M. Phipson stated that he had lately been trying to interest the Agricultural Department on the subject of bee culture in the hope that they might see their way to carry out properly conducted experiments on the domestication of the two species of Indian bees which are not migratory (*Apis nigrocinctus* and *Apis dorsata*), and also possibly to introduce the European hive bee (*Apis mellifica*). Seeing how largely honey is used by the people of this country for the preservation of fruit and for sweetmeats, it is surprising that bee culture has not been further developed. Dr. Thedore Cooke made some interesting experiments several years ago, in Poona, with *Apis indica*, but as this species of bee is known to be migratory the experiments led to disappointment, as on the approach of the hot season the swarms fled to the hills along with the Government officials. Had the experiments been made with the rock bee (*Apis dorsata*), which is twice the size of the other, the results might have been very different.

Mr. L. C. H. Young, the Honorary Secretary of the Insect Section, read some extracts from the latest work on the subject of Indian Hymenoptera, by Col. C. T. Bingham, and suggested that members of the Society living in the Punjab, Kolhapur, and other places, where experiments had been made, should be asked to communicate with the Society on the subject.

FLEAS.

The Honorary Secretary stated that Capt. W. G. Liston, I.M.S., had kindly offered to read another paper before this Society, at the November meeting, on the subject of fleas and the part they play in the propagation of plague. Capt. Liston, it will be remembered, read a paper on this subject on the 15th March 1903, but he has since devoted much time to it and an account of his recent investigations will be of the greatest interest.

PAPERS READ.

The following papers were read and discussed :—

1. Water-yielding Plants found in the Thana Forest, by G. M. Ryan, I.F.S. ; 2. Cassia occidentalis, by B. H. Barlow-Poole, I.F.S. ; 3. Birds observed in the Nilgiris and Wynaad, by A. M. Primrose ; 4 Notes on the Nesting of some Birds in the Upper Chindwin District, Burma, by Capt. H. H. Harrington ; 5. Notes on Burmese Reptiles, by Major G. H. Evans, A.V.D., F.L.S ; 6. Notes on the Hornbills of the Pegu District, by C. W. Allan, I.F.S ; 7. The Russell's Viper by Lt.-Col. L. L. Fenton ; 8. A Cobra Feeding on Eggs, by C. P. George, all of which will appear in full in the Society's Journal.

PROCEEDINGS

OF THE MEETING HELD ON THURSDAY, THE 24TH NOVEMBER 1904.

A meeting of the members took place at the Society's rooms on 24th November 1904, Colonel W. B. Bannerman, I.M.S., presiding.

NEW MEMBERS.

The election of the following new members, since the 1st meeting, was duly announced :—Mr. Julian North (Calcutta) ; Mr J. May (Parlakimedi, Ganjam District) ; Mr. A. Panton (Bombay) ; Mr. Purshotumdas Visram Maoji (Bombay) ; Rev. Joâo Rebello (Margâo, Goa) ; Captain C. B. Harrison, I.M.S. (Madura) ; Mr. T. D. Hamilton, I.F.S. (Rangoon) ; Mr. J. Harding Pascoe (Kolla Kombi, Nilgiri Hills) ; Mr. Gordon Dalgliesh (London) ; Mr. W. R. Le Grand Jacob, I.F.S. (Darjeeling) ; Mr. C. W. Dunn, I.C.S. (Rangoon) ; Lieutenant J. A. Pottinger (Rangoon) ; Captain W. D. A. Keys, I.M.S. (Bombay) ; Mr. G. F. Curran (Mysore) ; and Mr. C. G. de C. Ireland, I.C.S. (Dehra Dun).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's collection :—

Contribution.	Description.	Contributor.
1 Snake (alive)	*Lycodon travancoricus* ...	Col. W B. Bannerman, I.M.S.
1 Snake (alive)	*Lycodon aulicus*	Do.
A collection of Orthopterous Insects.	....	Mr. S. Lightfoot.
1 Snake (alive)	*Eryx johnii*...	Mr. R. C. Farrel, I.F.S.
1 Snake	*Dipsas multimaculata* ...	Mr. S. Lightfoot.
A collection of Mantidæ, Grasshoppers, &c.	....	Do.
1 Snake (alive)	*Helicops schistosus* ...	Capt. F. Wall, I.M.S.
1 Snake	*Callophis trimaculatus* ...	Capt. J. Oxley, I.M.S.
3 Lizards from Pegu ...	*Liolepis belliana*	Mr. C. W. Allan, I.F.S.
2 Flying Lizards from Pegu.	*Draco blanfordii*	Do.
A number of Cage Birds (alive).	....	Mr. G. De Saone.

Contribution.	Description.	Contributor.
4 Species of Snakes	*Lycodon aulicus, var. Lycodon travancoricus.*	Capt. F. Wall, I.M.S.
	Bungarus candidus	Do.
	Polyodontophis subpunctatus.	Do.
A number of Beetles	*Buprestidæ sp.*	Mr. F. G. Arnold.
1 Malay Bittern	*Gorsachius melanolophus*	Mr. R. G Foster.
1 Snake	*Bungarus candidus*	Mr. C. H. Donald.
1 Snake (alive)	*Zamenis mucosus*	Do.
1 Crimson-breasted Barbet or Coppersmith.	*Xantholæna hæmstocephala.*	Maj. C. G. Nurse, F.E.S.
1 Indian Pied Kingfisher	*Ceryle varia.*	Do.
1 Franklin's Nightjar	*Caprimulgus monticola*	Do.
1 Pied Crested Cuckoo	*Coccystes jacobinus*	Do.
1 Rose-ringed Paroquet	*Palæornis torquatus*	Do.
1 Painted Sand-grouse	*Pterocles fasciatus*	Do.
1 Large or Black-bellied Sand-grouse.	*Pterocles arenarius*	Do.
1 Large Pin-tailed Sand-grouse.	*Pteroclurus alchata*	Do.
3 Common Sand-grouse	*Pteroclurus exustus*	Do.
1 Grey Partridge	*Francolinus pondicerianus,*	Do.
1 Red Shank	*Totanus calidris*	Do.
4 Wood-snipes	*Gallinago nemoricola*	Mr. S. Lightfoot.
1 Western Bamboo Partridge.	*Bambusicola fytchii*	Do.
A collection of Mantidæ	....	Do.
1 Snake	*Psammophis leithii*	Mr. T. Ruttonji.
1 Snake (alive)	*Dipsas forsteni*	Col. Bannerman, I.M.S.
1 Snake	*Simotes arnensis*	Mr. C. H. Donald.
1 Snake	*Oligodon sp...*	Do.
1 Snake "Dhaman"	*Zamenis mucosus*	Mrs. Inglis.
2 Hawk Bill Turtles from Port Blair (alive).	*Chelone inbricata*	Mr. C. Gilbert Rogers, I.F.S.
31 Eggs of Roseate Tern	*Sterna dougalli*	Mr. W. F. Jardine.
3 Snakes	*Lycodon aulicus,* dark variety.	Col. W. B. Bannerman, I.M.S.
1 Black-tailed Godwit	*Limosa ægocephala*	Mr. H. S. Symons.
1 Snake (alive)	*Trimeresurus monticola*	Mr. A Wright.
2 Snakes	*Psammodynastes pulverulentus.*	Mr. J. Donaghey.
1 Snake	*Polyodontophus collaris*	Do.

PLAGUE, RATS, AND FLEAS.

Captain Liston defined plague as a rat disease which was not unfrequently under favouring circumstances communicated to man. The disease, therefore, among men might almost be said to be accidental and certainly avoidable if there were a distance between rats and men. He said that the idea that rats played the most important part in the spread of plague was no new one, it was recognised by the ancients as well as by more recent authorities who had practical experience of the disease If it was a rat's disease then it was likely that the disease had its own distinct laws of origination and continuance among these animals. It was precisely this study of the disease in rats that had been neglected. Before any progress could be made we wanted to know more about the life and habits of rats. He then proceeded to discuss a few of the habits of rats that had an important bearing on the spread of plague. He considered, first, the species of domestic rats. There were two very distinct species: *Mus decumanus*, the common rat found in Europe; it was a burrowing rodent and lived in drains and cellars. *Mus rattus* was the common rat of Bombay and the East generally; it lived in the roofs of houses and even trees; it was a truly domestic rat. Plague might rage as an epizootic among rats of the species of *Mus decumanus* and man would have little chance of infection, but an epizootic of this disease among rat of the species *Mus rattus* was very liable to be communicated to man. The species of rat affected with plague had an important bearing on the spread of the disease in man, not from any inherent difference in the susceptibility to the disease in the particular species, but because of the habits of the species. The disappearance of plague from Europe was coincident with the invasion of that Continent by the brown rat and the displacement of the black rat by that species. While the habits of the black rat played an important part in the spread of plague, the habits of men encouraged or discouraged the prevalence of this species of rat. In Europe the brown rat displaced the black rat as pucca buildings became erected, as drainage systems were developed, as stables were separated from dwelling-houses, as shops, warehouses and granaries were no longer used as human habitation. As stone and wooden floors displaced mud and rush-covered ground, as beds became used in place of heaps of straw, so the black rat was driven from his haunts and the brown rat had it all his own way, man and rats were separated from one another and plague ceased to trouble, for man played an important part in spreading the diseases among rats. Rats like men were gregarious in their habits, they had their maharwaras and buniapuras, some rats lived on the refuse of the people and others installed themselves in the granaries of the rich. There was little communication between these communities in the same village or town, and there could be still less communication between the rats of one town and those of another except through human agency. Ships, railways, and roads, the means of conveyance of merchandise, were also the means of communication between rats of one town and those of another; the rats as "stowaways" were conveyed with human merchandise. As this was a chance means of communication, the larger the means of transport the chances were greater: hence ships transferred rats in this way more frequently than railway trains. Seaport towns, therefore, were specially liable to be infected by this method, *viz.*, from rat to rat through merchandise conveyed by man. Another habit of rats that had an important bearing on the spread of plague was their habit of migrating as a community when scared by an unusual mortality among them In this habit they resembled man. Plague could under these circumstances be spread from one rat community to another rat community in the same town where fresh focus of infection might be set up. This habit also increased the chances of infected rats being conveyed by merchandise. Again, the breeding season of rats played an important part in the spread of plague, because the number of susceptible individuals was increased; and (2) the number of fleas (the transmitters of infection) were also greatly multiplied. If plague was a rat disease, how was it communicated to man? He then passed on to consider how the flea acted as a transmitter of infection. He classed plague together with certain epizootic diseases which were communicable to man, *viz.*, anthrax, glanders, and hydrophobia. He considered the means by which these diseases were transmitted, and said that plague differed from them all. The microbe of this disease produced no spore or seed like the anthrax bacillus, it multiplied by fission as a plant might be multiplied by cuttings. There were two sorts of cuttings: resistant, which could be kept out of their natural soil for a long time, and non-resistant, which had to be placed shortly after removal from the parent plant into suitable soil. The germ that caused glanders belonged to the former class; the plague germ and the virus of hydrophobia to the latter class. But in the cases of hydrophobia there was direct transferrence of the poison from the rabid dog to man by a bite. This did not usually occur in plague. There was a third method of reproducing plants, *viz.*, by using a gooty. It was by this method that plague was propagated in men and animals. The flea acts as the gooty. The plague germ found in the flea's stomach a daily supply of the very food it required, *viz.*, animal blood; it was not acted on by the digestive juices of the flea, and here it was securely protected from light, dessication, and contaminating bacteria, which acted on the plague germ as weeds do on a delicate plant. The flea, however, being animate acted both as gooty and mali, and transferred the plague germ by its bite to suitable soil, the animal body. He then considered the various species of fleas, and some of their habits. He pointed out that flea-ridden animals often had their own characteristic flea. The rat flea was seldom found on man; how, then, could plague be conveyed from rat to man or from man to rat by means of fleas? He detailed how the question had been solved. It depended on the migration of rats in the presence of an unusual mortality among them. They left their fleas behind and these latter in sheer hunger attacked men and other animals. He recorded experimental proof of this fact in the case of a certain epidemic among guineapigs and in the case of an outbreak of plague in a chawl in Bombay. While normally rat fleas were never found on guineapigs, in the above case they swarmed on them. 18 alone were taken on one sick guineapig. Man seldom harbours the rat flea; he had found one rat flea in 246 fleas caught on man under normal conditions. In the case of the chawl above recorded, of 30 fleas caught on man no less than 14 were rat fleas. He then briefly referred to experimental methods of plague infection in animals, and stated that one or two germs were able to kill an animal when introduced under the skin by a needle, while millions of germs were necessary by any other method. Which, then, was likely to be the most common method of infection? Granted that infection generally occurred through the skin, he showed that there was a mass of evidence against the introduction of the bacillus through accidental cuts and abrasions, and everything pointed to the virus being introduced by such an insect as the flea. He also explained the seasonal and endemic prevalence of plague in terms of the habits of rats and fleas. He pointed out that infection in neighbouring towns and villages was chiefly conveyed by man to rats by means of rat fleas carried on clothing. He concluded by pointing to many facts in connection with the epidemiology of plague which could be explained in no other way than that the flea was the transmitter of infection—such facts as the notorious infectivity of houses particularly at night, and the efficiency of oil and tobacco as preventives against plague. He would have liked to consider preventive measures against plague, but time did not permit. He said, however, that to his mind since it was impossible to place a distance between rats and man except by years of sanitary improvement and education, the only method that held out any hope of salvation now and until sanitary reforms were carried out, was to acquire immunity to plague by inoculation.

The Honorary Secretary stated that Captain Liston's paper would be published in full in the Society's Journal.

OTHER PAPERS.

The following papers were also read and discussed :—" Bee Culture in India," by Major C. G. Nurse. " Description of a new Snake," " Oligodon McDougalli, by Captain F. Wall, I.M.S., C.M.Z.S. " The Butterflies of Ceylon." by Major N. Manders, R.A.M.C., F.Z.S., F.E.S.

PALMS GROWING IN BOMBAY.

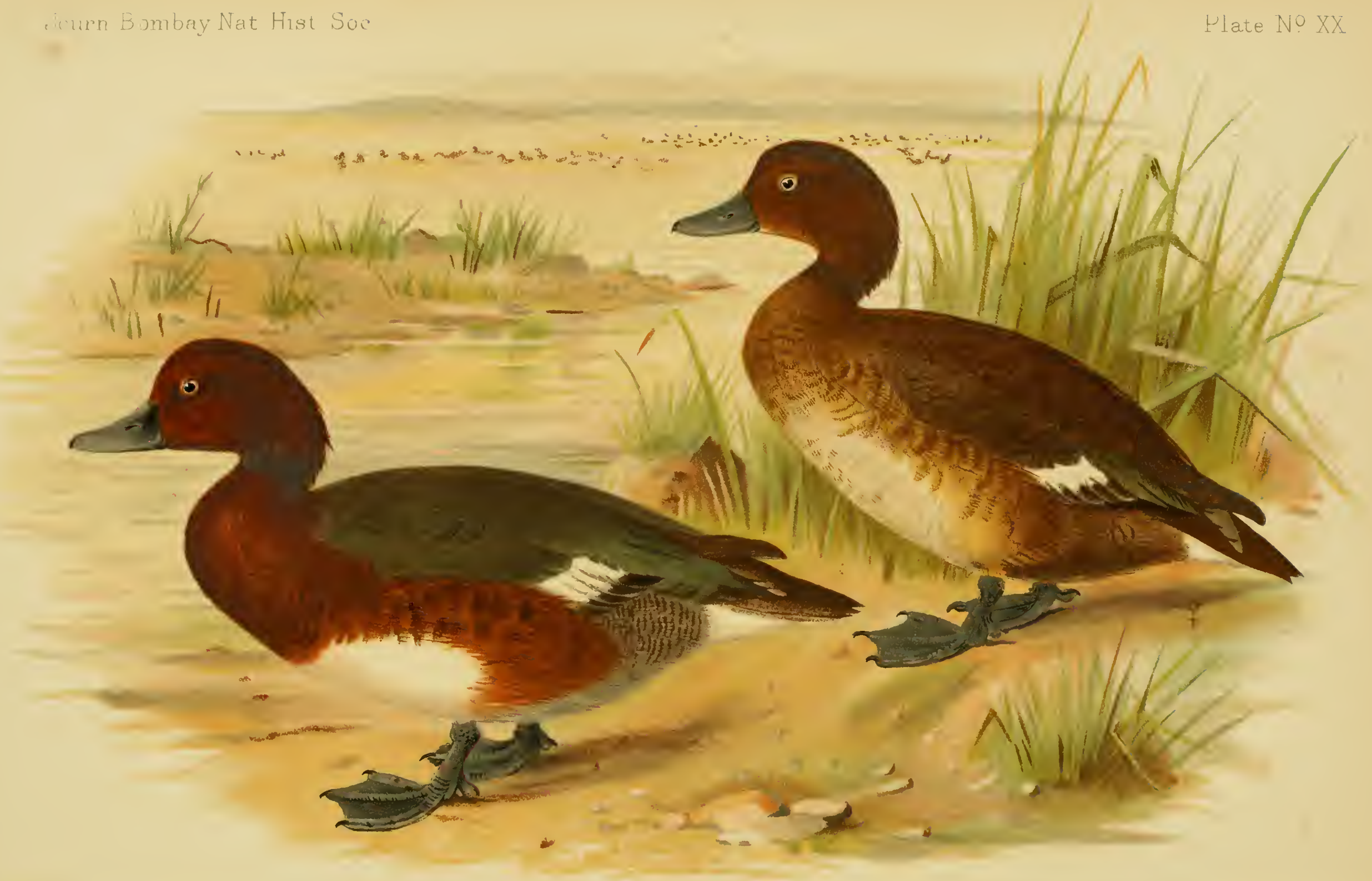
Mr. H. M. Phipson exhibited photographs of 21 different species of palm trees growing in Bombay under natural conditions.

COBRAS DIGESTING WHOLE EGGS.

Colonel W. B. Bannerman, I.M.S., stated that with reference to Mr. C. P. George's paper on this subject, read at the last meeting of the Society, he had, as then promised, made several experiments with the live cobras in his possession at the Government Laboratory at Parel, which showed that a hen's egg, with the shell intact, if pushed carefully down into the snake's stomach, became entirely dissolved in the course of 48 hours.

VANILLA FRUITING IN BOMBAY.

Mr. C. D. Mahaluxmiwala exhibited a bunch of vanilla pods grown in the Victoria Gardens, and explained the process of artificial fertilization which it was necessary to resort to in this country in the absence of the proper insect.



H Gronvold del.

Mintern Bros. Chromo lith London.

THE WHITE-EYED POCHARD.

Nyroca africana

JOURNAL

OF THE

BOMBAY

Natural History Society.

Vol. XVI. BOMBAY. No. 2.

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES III. PART III.

By Sir George Hampson, Bart., F.Z.S., F.E.S.

(*Continued from page* 151 *of this Volume.*)

ZYGÆNIDÆ.

501*c*. CLELEA REFULGENS. n. sp. (Pl. D, f. 3).

♀. Black; head, thorax and abdomen suffused with golden green, antennæ with violet-blue. Forewing with the basal half suffused with golden-green with copper reflections; a golden-green discoidal spot and postmedial band excurve from costa to vein 4, then oblique and not reaching inner margin; a brilliant blue-green terminal line. Hindwing with the base brilliant metallic blue extending as a streak below cell to beyond middle and on inner area nearly to tornus. Underside of forewing with metallic blue streaks on costa and below cell to middle; hindwing with the base metallic blue extending on costal area to beyond middle and continued as a fine line to apex and on termen, in cell to middle and on area below the cell to termen, a discoidal spot.

Habitat.—MANIPUR, MAO 6000′ (Doherty). *Exp.* 28 mill. *Type*—in B. M.

532. PIDORUS GEMINUS, insert (syn.) *Pidorus leno*, Swinh., A. M. N. H. (7) 6a, p. 305.

p. 269. Under CYCLOSIA insert (syn.) *Pintia*, p. 258.

545. *Pintia ferrea* is the ♂ of 577. CYCLOSIA PAPILIONARIS and 575 *C. nigrescens* and 576 *C. parvula* are varieties.

547. *Pintia* LATIPENNIS is the ♂ of 578. CYCLOSIA *australinda*, many specimens of both sexes bred (T. R. Bell).

PSYCHIDÆ.

625*a*. ACANTHOPSYCHE (*Dasaratha*) CANARENSIS. n. sp.

♂. Uniform cupreous brown. Forewing with veins 4-5 stalked; 7 from cell. Hindwing with vein 5 from middle of discocellulars.

Habitat.—Kanara, Karwar (Davidson). *Exp.* 24 mill. *Type*—in B. M.

636*a*. Psyche (*Heylaertsia*) laniata, n. sp.

♂. Head, thorax and abdomen black-brown clothed with long hair; antennæ with long branches to near extremity; wings rather thickly clothed with long black-brown hair-like scales. Forewing with vein 3 from before angle of cell; 5 from above angle; 6 from well below upper angle; 7·8 shortly stalked; 9·10 on a long stalk; 11 from cell. Hindwing with vein 3 from before angle of cell; 4·5 stalked; 6 absent.

Larva case covered with fragments of leaves, straw, etc.

Habitat.—Ceylon, Matalé (Pole). *Exp.* 14 mill. *Type*—in B. M.

Cossidæ.

651*c*. Cossus cashmirensis is a distinct species from acronyctoides; the antennæ are bipectinate with the branches long at base, whilst in the latter they are unipectinate with the branches short at base, then increase in length before middle; the former also is a larger, broader-winged insect with the markings darker.

Section III. Antennæ of male thickened and laminate, but not pectinate.

651*b*. Cossus fuscibasis.

651*b*. Cossus rufidorsia, n. sp. (Pl. D, f. 5).

♂. Head, thorax and abdomen grey-brown with a rufous tinge. Forewing grey-brown thickly striated with dark-brown; the inner area tinged with rufous; an indistinct dark line from costa beyond middle to inner margin near tornus and with another indistinct line just beyond it; an obscure irregular subterminal line furcate in places. Hindwing fuscous brown.

Habitat.—Sikhim (Dudgeon). *Exp.* 36 mill. *Type*—in B. M.

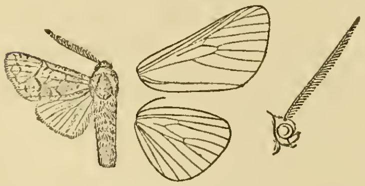
Genus Paracossus, nov.

Palpi upturned slender not quite reaching vertex of head; antennæ of male bipectinate with short branches diminishing regularly to apex; tibiæ with the spur short, hind tibiæ with two pairs. Forewing with vein 3 from before angle of cell; 5 from above angle; 6 from below or from upper angle; 7. 8. 9. 10 stalked; 11 from cell. Hindwing with veins 3·4 from angle of cell, 5 from above angle; 6 from below upper angle; 8 free.

Section I. Forewing with vein 6 from angle of cell.

656*b*. Paracossus parva, n. sp.

♂. Pale grey-brown; abdomen darker dorsally. Forewing with fine dark striæ; the inner area tinged with reddish brown; a fine black medial line slightly bent outwards at median nervure below which it is excurved; an oblique line from costa to upper angle of cell, then following the discocellulars and with a slight fork on outer side, bent inwards on median nervure and angled outwards on vein 2, then incurved; a postmedial line incurved from costa to vein 4 where it is angled



Paracossus parva ♂.

outwards, then incurved and sinuous and connected by an oblique streak at vein 4 with the irregularly waved subterminal line which is indistinctly forked in places. Hindwing semihyaline fuscous brown with the veins darker.

Habitat.—CEYLON, Matelé (Pole). *Exp.* 28 mill. *Type*—in B. M.

Section II. Forewing with vein 6 from well below angle of cell.

656*c*. PARACOSSUS, FURCATA. n. sp. (Pl. D, f. 30).

♀. Brownish-grey. Forewing with dark striæ, an indistinct oblique brown antemedial line bifurcating and enclosing an eliptical spot at middle; a medial line bent obliquely outwards from median nervure to submedian fold where it is connected by a streak with the postmedial line which is strongly incurved below vein 4 where it is connected by an oblique spur with the irregularly waved subterminal line which is obscurely furcate in places. Hindwing pale fuscous brown.

Habitat.—PEGU, Magane. *Exp.* 34 mill. *Type*—in B. M.

DREPANIDÆ.

712*a*. DREPANA FULVICOSTA, Dudgeon, J. Bomb. Soc., XII, p. 652 (1899).

Almost pure white; frons brown; antennæ, tibiæ and tarsi tinged with fulvous; wings irrorated with silvery scales. Forewing with the costal edge pale fulvous; a very indistinct oblique waved medial line from cell to inner margin and similar postmedial and subterminal lines. Hindwing with indistinct waved postmedial and two subterminal lines.

Habitat.—PUNJAB, Manpuri; BHUTAN. *Exp.* 34-38 mill.

741. PROBLEPSIDIS ALBILINEA, Warr. Nov. Zool., VI., p. 4.

♂. Antennæ strongly laminate; forewing with vein 11 from the cell.

Brownish-ochreous irrorated with black; palpi, frons and fore tibiæ and tarsi in front black; abdomen dorsally suffused with black. Forewing with two highly waved, curved, indistinct fuscous antemedial lines; a similar medial line; two very obliquely placed black discoidal points; a postmedial highly waved line oblique from vein 4 to inner margin before middle; a similar outer postmedial line with interrupted white strigæ on its oblique portion; a subterminal dentate line with black points on it; cilia chequered with black. Hindwing with two nearly straight antemedial lines; the medial area yellow with a black discoidal point; a dentate line just beyond middle followed by two indistinct waved lines, then a nearly straight postmedial line; a subterminal line of small dentate marks; a fine terminal line.

Habitat.—ASSAM, Khasis. *Exp.* 42 mill.

744*a*. DEROCA HIDDA, Swinh., A. M. N. H. (7), 6, p. 306.

Differs from *hyalina* in its small size; the vertex of head white. Forewing with the antemedial and medial lines angled inwards in submedian interspace.

Habitat.—ASSAM, Jaintia Hills. *Exp.* 32 mill.

746*a*. PHALACRA MULTILINEATA, rename P. ACUTIPENNIS, Swinh. A. M. N. H. (7), XI., p. 502 (1903).

747. PHALACRA EXCISA, insert (syn.) *P. multilineata*, Warr., Nov. Zool., IV., p. 16.

THYRIDIDÆ.

764*a*. STRIGLINA IGNEPICTA. n. sp. (Pl. D, f. 6).

♂. Head, thorax and abdomen olive-brown; palpi and antennæ marked with white; pectus white; legs banded with white; abdomen with subdorsal fiery red spots on last three segments and a slight white dorsal line on terminal segment, the ventral surface banded with white. Forewing dark olive-brown with darker striæ; a maculate patch of fiery red below costa beyond middle with some white points above it on costa; an ochreous spot in end of cell with a round hyaline spot below it; cilia white at tips. Hindwing dark olive-brown with slight fiery red suffusion between vein 5 and tornus towards which it develops into more distinct spots; cilia white at tips. Underside strongly striated with white; forewing with the yellow in end of cell extending round the hyaline spot and with some silvery suffusion before and beyond it.

Habitat.—BOMBAY; Castle Rock (Davidson). *Exp.* 14 mill. *Type*—in B. M.

811. DYSODIA IGNITA, insert (syn.) *Dysodia bipuncta* and *D. levis*, Warr., Nov. Zool., VII., p. 100.

LIMACODIDÆ.

822*c*. MACROPLECTRA CEYLONICA. n. sp.

♂. Yellow-brown irrorated with fuscous. Forewing with ill-defined antemedial black line from cell to inner margin; a very ill-defined postmedial line from vein 8 to 3. Hindwing black-brown, the cilia yellow-brown.

Habitat.—CEYLON, Matalé (J. Pole). *Exp.* 16 mill. *Type*—in B. M.

822*d*. MACROPLECTRA INCONSPICUA, n. sp.

♂. Antennæ greatly thickened and flattened.

Ochreous; head, thorax and forewing to the obscure, very oblique postmedial line, suffused with rufous.

Habitat.—BOMBAY, Castle Rock (Davidson). *Exp.* 12 mill. *Type*—in B. M.

852*a*. CONTHEYLA ROTUNDA, n. sp.

Grey-brown. Forewing with slight dark irroration; a series of black points from costa beyond middle, excurved to vein 6, then becoming subterminal; hindwing slightly darker; cilia of both wings yellowish at base.

Habitat.—N. KANARA, Karwar (T. R. Bell). *Exp.* ♂ 16, ♀ 20 mill. *Type*—in B. M.

COCOON covered with white secretion leaving points and patches of red-brown.

This species resembles the genus *Spatulifimbria* except in length of palpi.

874*a*. IDONAUTON NIGRIBASIS, n. sp. (Pl. D, f. 31).

♂. Antennæ much thickened and rather flattened with a large tuft of scales between their bases; cilia of both wings very long and spatulate at extremities.

Head and thorax black-brown, the vertex of former rufous; abdomen rufous tinged with fuscous. Forewing rufous; the basal area black-brown with nearly straight outer edge; cilia dark-brown and grey at tips. Hindwing fuscous brown; cilia dark brown and grey at tips.

Habitat.—N. KANARA, Karwar (T. R. Bell). *Exp.* 16 mill. *Type*—in B. M.

884*a*. CANIA *notodonta*, insert 891*a*. *Narosa* UNIFORMIS, Swinh., which has priority.

885*a*. CANIA PLUMBIFUSA, n. sp. (Pl. D, f. 7).

♂. Antennæ bipectinate to apex. Head, thorax and abdomen ochreous tinged with brown; palpi, frons and forelegs fuscous. Forewing ochreous suffused with leaden silvery especially on costal area; an ill-defined waved rufous line on discocellulars, then retracted to origin of vein 2, then to before middle; subterminal line blackish, bent outwards below costa; then punctiform to vein 5, then obsolete and represented by some black scales above tornus. Hindwing ochreous, the cilia dark at tips, at apex and towards tornus. The underside with the costal half of forewing suffused with black; a blackish discoidal spot.

Habitat.—ASSAM, Khàsis. *Exp.* 20 mill. *Type*—in B. M.

894. BELIPPA FERRUGINEA is a distinct species; B. LALEANA is the ♀ of 896 *B. Apicata* and it, as also the ♀ of B. LOHOR, is indistinguishable from the same sex of B. FERRUGINEA, whilst the males are quite distinct.

LASIOCAMPIDÆ.

901. TARAGAMA DORSALIS.

Larva. 1·85″. Reddish-brown with long buff-colored hairs hanging down from head and sides, erected when the larva moves or is disturbed; head covered with hairs; the 2nd and 3rd somites with a sort of hood covering a band of deep umber-brown; each somite with a prominent dorsal red tubercle with short black hairs and a smaller red tubercle behind it; the 12th somite with two very prominent black tubercles with black hairs; a lateral series of buff-colored tubercles from which the long hairs arise.

Food plant various Acaccias. (W. H. Campbell.)

938*a*. LENODORA CRENATA, Hmpsn.

♂. Head, thorax and abdomen pale ochreous brown; anal tuft rufous. Forewing red-brown, an ochreous white streak on subcostal nervure from base to just beyond upper angle of cell; a dull ochreous band beyond the cell between veins 8 and 2, diffused on inner side, its outer edge very oblique and crenulate. Hindwing pale red-brown, the costal area and cilia rather darker.

Habitat.—CEYLON, Horton Plains 6-7000′. *Exp.* 42 mill.

940*b*. LENODORA HYALOMELÆNA, n. sp. (pl. D, f. 9).

♂. Head, thorax and abdomen mauve-grey; palpi and sides of face, pectus, legs, and ventral surface of abdomen pale yellowish. Forewing fuscous black; the costal edge pale yellowish; an oblique semihyaline white band from below apex to above inner margin near base where it is met by pale hair at base; some white hairy scales on termen and in cilia. Hindwing hyaline; the veins, costal area and termen fuscous black; cilia white at tips.

Habitat.—MADRAS, Palni Hills, 7000′. (Campbell.) *Exp.* 38 mill. *Type*—in B. M.

942*a*. ODONESTIS FOSSA, Swinh., A. M. N. H. (6) XIX., p. 410. (Pl. D, f. 14.)

♂. Dark red-brown. Forewing with indistinct antemedial line angled outwards below costa; a small dark-edged white discoidal spot; a straight oblique dark-brown line from apex to inner margin before middle; an indistinct oblique strongly dentate subterminal line. Hindwing with traces of a slightly incurved line from apex to tornus.

♀. Yellower brown; forewing with the oblique line very slightly curved towards inner margin.

Habitat.—ASSAM, Jaintia Hills. *Exp.* ♂ 52, ♀ 66 mill.

LYMANTRIADÆ.

971. AROA *pyrhochroma,* insert *Orgyia* MELAXANTHA, Wlk., XXXIII., 324 (1865) which has precedence; the type must have come from India, not Cape Colony.

975*a*. AROA CAMPBELLI, n. sp. (Pl. D, f. 8).

♂. Head and thorax olive-brown; abdomen grey mixed with fuscous. Forewing pale olive thickly suffused and irrorated with fuscous brown; some diffused white on basal inner area; a pale olive medial striga from costa; an oblique white band irrorated with brown from costa beyond middle to middle of inner margin towards which it expands widely, slightly incurved to costa and with its outer edge indented at vein 5. Hindwing pure white with terminal olive fuscous band, moderately wide at apex, narrowing to a point at tornus.

Habitat.—MADRAS, Palni Hills, 6000′. (Campbell.) *Exp.* 26 mill. *Type*—in B. M.

982. LÆLIA EXCLAMATIONIS, insert (syn.) *Lælia adalia,* Swinh. A. M. N. H. (7), vi, p. 305. A large form from the Jaintia Hills. *Exp.* ♂ 42, ♀ 50 mill.

976. LÆLIA SUFFUSA.

Larva. Black clothed with rather long whitish hairs and with tufts of long spatulate black hairs on each side of 1st somite and in middle of 11th somite; four brown dorsal pencils of hair on 4th-7th somites; round whitish dorsal tubercles on 9th and 10th somites; a broad subdorsal yellow line and lateral yellow striations obscured by the hairs; a sublateral yellow line. Head and legs pale brown or black. Food plant—grasses.

Pupa in a rather loose pale buff or brownish cocoon. (Dudgeon.)

983. LÆLIA TESTACEA.

Larva. Dark buff with a paler dorsal stripe with dark medial line; neck canary-yellow; each somite with prominent tuft of brown hairs; very thick tufts of umber-brown hairs on somites 4, 5, 6 and 7; head glabrous, brown.

989*a*. PANTANA OCHROTA, n. sp. (Pl. D, ff. 33-34).

♂. Head and thorax fulvous yellow, the branches of antennæ blackish; abdomen dark fulvous brown. Forewing fulvous yellow, the costal half suffused by red-brown, at termen extending to vein 2; a yellowish discoidal lunule. Hindwing with the costal half fuscous brown, the inner half fulvous.

♀. Uniform ochreous, the abdomen more orange.

Habitat.—TRAVANCORE, Pirmad (R. S. Imray). *Exp.* ♂ 38, ♀ 52 mill.

993. THIACIDAS POSTICA.

Larva. 1·3″. Head red with white V-mark; body pale yellow-green with broad white dorsal stripe edged by faint black crenulate lines; a lateral series of black spots; six red tubercles on each somite from which arise long grey hairs. Food plant—*Zizyphus jujuba.* (W. H. Campbell.)

1004*a*. DASYCHIRA CEREBOSA, Swinh. Trans. Ent. Soc., 1903, p. 483 (Pl. D, f. 23).

Head, thorax and abdomen brown mixed with grey; antennæ of male with the branches rufous. Forewing grey, thickly irrorated with brown; an indistinct curved sub-basal line from costa to submedian fold; a double waved antemedial line; discoidal lunule defined by brown; postmedial line minutely dentate, slightly angled outwards below costa and at vein 4, then incurved; an indistinct diffused waved subterminal line. Hindwing pale brownish; the underside greyish thickly irrorated with brown, a discoidal spot and diffused postmedial line.

Habitat.—PUNJAB, Simla. *Exp.* ♂ 44, ♀ 50 mill.

1014*b*. DASYCHIRA MAGNALIA, Swinh. A. M. N. H. (7), XXII, p. 198 (1903) (Pl. D, f. 24).

♂ Head, thorax and abdomen dark brown mixed with grey. Forewing dull reddish-brown suffused with fuscous and slightly irrorated with grey; an ill-defined rufous patch below base of cell irrorated with large dark scales; an erect waved black antemedial line; an ill-defined lunulate ochreous discoidal patch with its centre defined by black, a dentate postmedial line angled outwards at veins 7 and 4, then strongly incurved; an ill-defined pale rufous subterminal line angled outwards at vein 7, inwards at discal and submedian folds and excurved at middle. Hindwing reddish fuscous brown; the underside with discoidal spot, postmedial line angled outwards at discal fold and indistinct diffused subterminal line.

♀ Rather uniformly darker, the lines of forewing less distinct.

Habitat.—ASSAM, Khásis. *Exp.* 42 mill.

1030*a*. LYMANTRIA MŒSTA, Swinh., Trans. Ent. Soc., 1903, p. 484 (Pl. D, f. 22).

♂. Head and thorax grey mixed with brown; abdomen brownish grey. Forewing brownish grey, thickly irrorated with fuscous; an indistinct antemedial line angled outwards below costa; an oblique black streak on lower discocellular with a diffused oblique fuscous striga above it on costa; an indistinct dentate subterminal line slightly angled outwards at veins 7 and 4, then incurved. Hindwing pale brownish.

♀ Wings rather greyer.

Habitat.—PUNJAB, Kasauli, Kangra Valley. *Exp.* ♂ 38, ♀ 44 mill.

1031. LYMANTRIA *obsoleta*, insert *Bombyx* SERVA, Fabr. Syst. Ent. 3, I, p. 474 (1793) which has precedence.

1049. GAZALINA CHRYSOLOPHA insert. (syn.) *Gazalina intermixta*, Swinh. A. M. N. H. (7) 6, p. 306.

1057*a*. EUPROCTIS VIRGO, Swinh. Trans. Ent. Soc., 1903, p. 393 (Pl. D, f. 26).

♂ Pure white; tibiæ tinged with fuscous; anal tuft orange; underside of forewing with the costal area suffused with fuscous.

Habitat.—Burma, Rangoon, Thayetmyo, Katha, Mandalay. *Exp.* 24 mill.

1063. Euproctis inconcisa del. *Artaxa dispersa.*

1065*a*. Euproctis macrostigma, n. sp. (Pl. D, f. 29).

♂. White; antennæ and thorax tinged with orange. Forewing with the costa tinged with orange; the wing irrorated with large orange scales below costa to beyond middle, from cell to inner margin from before middle, extending up to vein 5 beyond the cell and to termen between veins 5 and 3; a large round black spot in end of cell and two subapical spots, the upper small. Hindwing slightly tinged with yellow.

Habitat.—Ceylon Kandy (Pole). *Exp.* 18 mill. *Type*—in B. M.

1071*a*. Euproctis laniata, n. sp. (Pl. D, ff. 10-11).

♂. Head dull ochreous; palpi blackish at base; antennæ brown; thorax ochreous mixed with black; abdomen black with some ochreous hair at base, the anal tuft orange at tip; pectus, legs and ventral surface of abdomen ochreous. Forewing black, the basal area irrorated with large ochreous scales; the costa orange; ante- and post- medial ochreous lines formed by large erect scales and angled in discal fold; cilia orange. Hindwing black, the cilia orange.

♀ Head, thorax and forewing clothed with very long rough white woolly hair; the black areas replaced by brown; the costa of forewing, the lines and cilia of both wings yellowish white.

Habitat.—Madras, Palni Hills, Kodaikanal, 7500′ (Campbell). *Exp.* ♂ 36, ♀ 32 mill. *Type*—in B. M.

1072*a*. Euproctis dana, Swinh. Trans. Ent. Soc., 1903, p. 408 (Pl. D, f. 32).

♂. Fulvous orange. Forewing with fine pale very slightly waved medial line and almost straight postmedial line. Hindwing fulvous brown, the cilia orange. Underside of both wings suffused with fuscous brown except the margins and cilia.

Habitat.—Kashmir, Dana. *Exp.* 22 mill.

1074*c*. Euproctis fulvinigra, n. sp. (Pl. D, f. 4).

♂. Head and thorax orange fulvous; legs whitish; abdomen fuscous black with the anal tuft mostly fulvous. Forewing orange fulvous with slight darker irroration; the costa pale; pale ante- and post- medial lines, the former angled on median nervure, the latter excurved at median nervules. Hindwing fuscous black, the cilia whitish; the underside irrorated with whitish, the costal area white.

♀. Abdomen fulvous tinged with fuscous, the anal tuft fulvous; hindwing with the termen and cilia yellow.

Habitat.—Sikhim (Pilcher); Khasis. *Exp.* 26 mill.

1077. Euproctis *guttata*, insert *Bombyx* flava, Fabr. Syst. Ent., p. 57*a* (1775) which has precedence.

1093*a*. Euproctis xanthosticta, n. sp. (Pl. D, ff. 12-13).

♂ Yellowish white ; thorax mixed with rufous. Forewing suffused with rufous and with traces of some six waved and diffused lines ; two orange spots below costa towards apex and a small spot above vein 3. Hindwing yellow.

♀ White. Forewing with a few fulvous scales below origin of vein 2 ; two fulvous spots below costa towards apex, a point below vein 6 and a spot above vein 3.

Habitat.—BOMBAY, Karwar, Kudra (Davidson). *Exp.* ♂ 28, ♀ 34 mill.

1102*a*. EUPROCTIS *bidentata,* insert *Artaxa* DISPERSA, Moore. Lep. Atk. p. 50, pl. ii., f. 6, which has precedence.

1102*b*. EUPROCTIS MIRABILIS, Swinh. Trans. Ent. Soc. 1903, pl. 415 (Pl. D, f. 28).

♂ Yellow ; palpi blackish above. Forewing, except costal area, overlaid with large brown scales and from before middle to the subterminal line with a number of still larger raised blackish scales, leaving an ill-defined medial yellow line excurved and forming a patch at median nervure ; the subterminal line represented by a series of silvery spots emitting short streaks below veins 7 and 4 ; the inner margin with large silvery scales and very long spatulate brown hairs from before middle to tornus ; terminal area with the vein streaked with orange.

♀ Forewing with the brown scaling and silvery spots carried outwards as broad fasciæ to termen below veins 7 and 4 ; abdomen brownish.

Habitat.—ANDAMANS, *Exp.* ♂ 26, ♀ 32 mill.

1114*a*. LEUCOMA PELLUCIDA, Swinh. Trans. Ent. Soc. 1903, p. 381 (Pl. D, f. 25.)

White ; frons and outer side of palpi pale orange ; femora and tibiæ tinged with orange ; mid tarsi of male with black streak on 1st joint above ; wings nearly hyaline, the costal edge of forewing and tips of cilia of both wings orange ; forewing with oblique black streak on lower discocellular.

Habitat.—ASSAM. Khásis. *Exp.* ♂ 46, ♀ 56 mill.

1124. DENDROPHLEPS SEMIHYALINA, ♀ like the ♂ in structure and appearance except that the wings are wholly white without any hyaline.

Habitat.—SIKHIM ; ANDAMANS.

The ♀ described, Swinh. Trans. Ent. Soc. 1895, p. 14, and Moths Ind., IV., p. 491, belong to *Caviria ochripes,* Moore.

RATARDIDÆ.

1130*a*. RATARDA FURVIVESTITA, n. sp. (Pl. D, f. 15).

♀ Head, thorax and abdomen fulvous. Forewing dark-brown with a slight reddish tinge ; the veins streaked with greyish ; traces of numerous greyish striated lines. Hindwing rather paler brown with a reddish tinge ; the veins greyish.

Habitat.—ASSAM, Khásis. *Exp.* 52 mill. Type—in B. M.

HYPSIDÆ.

1140*a*. HYPSA DONATANA, Swinh. A. M. N. H. (7) XI, p. 504 (1903) (Pl. D, f. 20s.)

♂ Head, thorax and abdomen orange ; palpi with the extremity of 1st and 2nd and the 3rd joints black ; antennæ black except 1st joint in front ; tegulæ patagia pro- and meta- thorax with black patches ; legs white streaked with black ; abdomen with dorsal bands and sublateral series of black spots. Forewing grey-brown, the veins streaked with white ; a basal orange patch with a black spot at base of costa, two subbasal spots and four on its outer edge, the one in cell small, elongate and displaced outwards ; a very large white patch extending from the orange patch to beyond middle and from discal fold to vein 1, beyond the cell extending up to vein 7, its outer edge oblique and dentate, at vein 2 extending to near termen. Hindwing white with postmedial black spot in discal fold and subterminal spots below vein 2 and at tornus ; a terminal maculate band interrupted by the white veins and narrowing from apex to tornus. The underside with elongate spot in cell of forewing and rounded spot at upper angle ; hindwing with the costal area black, spots in cell and on discocellulars and a postmedial spot above vein 7.

Habitat.—TENNASSERIM, Donat Hills. *Exp.* 60 mill.

1308*a*. MACROBROCHIS FLAVICINCTA, n. sp. (Pl. D, f. 21).

♂ Head, thorax and abdomen black-brown ; palpi orange except 3rd joint ; neck with broad orange ring ; abdomen with orange-yellow bands except dorsally on 1st two segments, the bands broader on ventral surface. Forewing black-brown ; a pale yellow fascia in base of cell, then bent downwards and in submedian fold extending to beyond middle ; a fascia on inner margin to beyond middle ; an eliptical spot in middle of cell ; a reniform discoidal spot with its lower edge slightly angled inwards on median nervure ; a small postmedial spot below costa and a band between veins 5 and 1, tapering above and constricted in submedian fold. Hindwing pale yellow ; some brown hair at base of inner margin ; a black-brown terminal band extending on costa to near middle, its inner edge bent outwards at vein 5, then sinuous to tornus ; the underside with dark costal fascia and subterminal spot below costa.

Habitat.—CACHAR. *Exp.* 56 mill. Type—in B. M.

Family ARCTIADÆ.

Sub-family ARCTIANÆ.

Key to the Genera.

A. Forewing with veins 7·8·9·10 stalked.
  a. Proboscis more or less aborted.
    a^1. Hind tibiæ with the medial spurs absent.
      a^2. Fore tibiæ with curved apical claw .... *Amsacta.*
      b^2. Fore tibiæ without apical claw.
        a^3. Head and thorax clothed with rough woolly hair .... *Manas.*
        b^3. Head and thorax smoothly scaled .... *Creatonotus.*
    b^1. Hind tibiæ with the medial spurs present.
      a^2. Fore tibiæ with curved apical claw.................... *Estigmene.*
      b^2. Fore tibiæ without apical claw..........................
      a^3. Thorax clothed with rough woolly hair.
        a^4. Eyes small .... *Phragmatobia.*
        b^4. Eyes large .... *Diacrisia.*

b^4. Thorax smoothly scaled .... *Pericallia.*
b. Proboscis fully developed........ *Nicæa.*
B. Forewing with vein 9 from 10 or 9 and 10 anastomosing with 8 to form the areole.
  a. Proboscis aborted, minute.
    a^1. Forewing with veins 9·10 anastomosing with 8 to form the areole .... *Euarctia.*
    b^1. Forewing with vein 9 from 10 anastomosing with 8 to form the areole........ *Arctia.*
  b. Proboscis fully developed.
    a^1. Palpi upturned the 3rd joint porrect.
      a^2. Forewing with vein 3 from close to angle of cell; hindwing with vein 8 from middle of cell. *Axiopæna.*
      b^2. Forewing with vein 3 from long before angle of cell; hindwing with vein 8 from near end of cell .... *Migoplastis.*
    b^1. Palpi with the 3rd joint upturned.
      a^2. Forewing with the areole long and narrow ...... *Rhodogastria.*
      b^2. Forewing with the areole shorter and broad.
        a^3. Hind tibiæ with the spurs long .... *Baroa.*
        b^3. Hind tibiæ with the spurs short........ *Utetheisa.*
    c^1. Palpi porrect .... *Secusio.*
c. Forewing with veins 7·8 and 9·10 stalked .... *Paraplastis.*

Genus NICÆA.

1243. NICÆA LONGIPENNIS.

Genus PHRAGMATOBIA.

	Type.
Phragmatobia, Steph. Ill. Brit. Ent. Haust. II., p. 7 (1828).........	*fuliginosa.*
Chelis, Ramb. Cat. Lep. And. II. p. 256 (1866)	*maculosa.*
Neoarctia, Neum. and Dyar. Ent. News. Philad. IV., p. 141 (1893).	*beani.*

Proboscis aborted, minute; palpi porrect, reaching as far as or to just beyond frontal tuft and clothed with long hair; eyes very small; head, thorax and abdomen clothed with rough woolly hair, the head retracted; tibiæ with the spurs short. Forewing with vein 3 from close to angle of cell; 4·5 from angle, or 5 from above angle; 6 from upper angle or stalked with 7; 7·8·9·10 stalked; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 from above angle; 6·7 from upper angle or stalked; 8 from middle of cell.

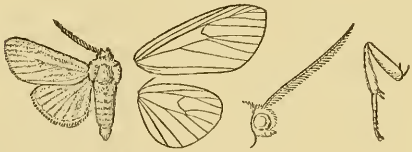
In the typical section the antennæ of male are ciliated.

Sect. II. *(Chelis)* Antennæ of male bipectinate with moderate branches.
  A. Forewing with the subterminal line angled inwards at vein 4........ 1208. *postflavida.*
  B. Forewing with the subterminal line not angled inwards at vein 4 .... 1205. *parvula.*

Genus MÆNAS.

	Type.
Mænas, Hübn Verz., p. 167 (1827)	*vocula.*
Lemyra, Wlk., VII, 1690 (1856)	*extensa.*
Borscba, Wlk., XXXI, 318 (1864)	*surgens.*
Savara, Wlk., XXXI, 320 (1864) nec. Wlk., 1862	*simplex.*
Bucæa, Wlk., XXXV, 1983 (1866)	*simplex.*
Palustra, Bar, Ann. Soc. Ent. Fr. (5) III, p. 300 (1873)	*laboulbeni.*
Eutænia, Wllgrn. Œfv. Svensk. Akad. Förh., XXXII (1), p. 132 (1876) nec. Thoms. Col. 1857	*scapulosa.*

Probosci aborted, minute; palpi porrect, not reaching beyond the frons; head, thorax, and abdomen clothed with rough woolly hair; antennæ of male bipectinate with long branches, of female with short branches; tibiæ clothed with rough hair, the spurs short, hind tibiæ with the medial spurs absent; abdomen of female with thick flocculent anal tuft. Forewing with vein 3 from towards angle of cell; 5 from above angle; 6 from upper angle; 7·8·9·10 stalked; 11 from cell. Hindwing with vein 3 from before angle of cell; 5 from first above angle; 6·7 from upper angle; 8 from middle of cell.



Mænas simplex ♂ $\frac{1}{1}$

A. Forewing pale brownish ochreous ....1240. *simplex.*

B. Forewing brown or blackish ......1241. *fumipennis.*

Genus DIACRISIA.

	Type.
Diacrisia, Hübn., Verz., p. 169 (1827)	*sannio.*
Rhyparia, Hübn., Verz., p. 183 (1827)	*purpurea.*
Cycnia, Hübn., Verz., p. 184 (1827)	*sordida.*
Cycnia, Hübn., Zutr., 1, p. 7 (1827) non descr	*tenera.*
Euthemania, Steph. Ill. Brit. Ent. Haust. II, p. 68 (1828)	*sannio.*
Spilosoma, Steph. Ill. Brit. Ent. Haust. II, p. 74 (1828)	*lubricipeda.*
Diaphora, Steph. Ill. Brit. Ent. Haust. II, p. 77 (1828)	*mendica.*
Aretinia, Eichw. Zool. Spec. II, p. 195 (1831)	*cæsarea.*
Lacydes, Wlk., III, 683 (1855)	*spectabilis.*
Alphæa, Wlk., III, 683 (1855)	*fulvohirta.*
Alpenus, Wlk., III, 686 (1855)	*maculosa.*
Aloa, Wlk., III, 699 (1855)	*lineata.*
Andala, Wlk., III, 774 (1855)	*unifascia.*
Isia, Wlk., VII, 1698 (1856)	*intricata.*
Sanura, Wllgrn. Œfv. K. Akad. Förh., XV, p. 214 (1858)	*lineata.*
Thyrgorina, Wlk., XXXI, 317 (1867)	*indica.*
Binna, Wlk., XXXI, 319 (1864)	*lutescens.*

Pyrrharctia, Pack. Proc. Ent. Soc. Philad, III, p. 120 (1864). *isabella.*
Echlida, Wlk., XXXII, 386 (1865) .... *indica.*
Icambosida, Wlk., XXXII, 400 (1865)................................ *nigrifrons.*
Acymba, Ramb. Cat. Lép. And., II, p. 235 (1869) .... *spectabilis.*
Eyralpenus, Butl. Cist. Ent., II, p. 35 (1875) .... *testacca.*
Spilarctia, Butl. Cist. Ent., II, p. 39 (1875) .... *lutea.*
Leucaloa, Butl. Cist. Ent., II, p. 44 (1875) .... *eugraphica.*
Epatolmis, Butl. Trans. Ent. Soc., 1877, p. 348 .... *cæsarea.*
Rhyparioides, Butl. A. M. N. H. (4), XX, p. 395 (1877) ...... *nebulosa.*
Thanatarctia, Butl. A. M. N. H. (4), XX, p. 395 (1877) ...... *infernalis.*
Gonerda, Moore P. Z. Z., 1879, p. 395 .... *perornata.*
Challa, Moore P. Z. S., 1879, p. 398 .... *bimaculata.*
Carbisa, Moore Lép. Alk., p. 41 (1879) .... *venosa.*
Hyarias, Swinh. Cat. Het. Mus. Oxon. 1, p. 184 (1892) .... *niceta.*
Elpis, Dyar. Ent. News. IV, p. 36 (1893) .... *nubra.*

Proboscis aborted, minute ; palpi porrect, hardly or just reaching beyond the frons ; head and thorax clothed with rough hair ; antennæ of male bipectinate ; tibiæ fringed with hair. Forewing with vein 3 from near angle of cell ; 5 from or from above angle ; 6 from or from below upper angle ; 7·8·9·10 stalked ; 11 from cell. Hindwing with vein 3 from near angle of cell ; 5 from or from above angle ; 6·7 from upper angle or shortly stalked ; 8 from near middle of cell.

A. Forewing with the ground color pure white.
- *a*. Wings sparsely clothed with hairy scales.
  - a^1. Tegulæ orange ....1189. *nigrifrons.*
  - b^1. Tegulæ not orange.
    - a^2. Abdomen crimson above ....1199. *rhodophila.*
    - b^2. Abdomen not crimson above.
      - a^3. Forewing with black point in upper angle of cell.
        - a^4. Forewing with antemedial series of spots angled on median nervure, and oblique series from apex ......1188. *multivittata.*
        - b^4. Forewing with curved antemedial and subterminal series of spots ...1187. *indica.*
      - b^3. Forewing without black point in upper angle of cell ....1200. *melanosoma.*
- *b*. Wings thickly and smoothly scaled.
  - a^1. Forewing with the markings consisting of more or less developed black points.
    - a^2. Abdomen crimson above ....1185. *erythrozona.*
    - b^2. Abdomen orange above ....1160. *lubricipeda.*
  - b^1. Forewing with maculate bands ....1190. *unifascia.*

- **B.** Forewing yellowish white, buff, yellow, or orange, sometimes tinged with crimson.
  - *a.* Hindwing with the ground color whitish or buff.
    - a^1. Abdomen orange above.
      - a^2. Forewing whitish to buff.
        - a^3. Wings not suffused with fuscous.
          - a^4. Forewing with antemedial black or fuscous spot or point on costa.
            - a^5. Forewing without short subterminal streaks on each side of median nervules.
              - a^6. Patagia with black points ......1161. *subfascia.*
              - b^6. Patagia without black points.
                - a^7. Femora crimson above .... *obliqua* ab. *todara* ♀
                - b^7. Femora orange above ....1163. *punctata* ♂.
            - b^5. Forewing with short subterminal streaks on each side of median nervules ....1166. *mona.*
          - b^4. Forewing without antemedial black spot or point on costa.
            - a^5. Forewing with incomplete series of points from apex.
              - a^6. Palpi crimson at base................ *obliqua* ab. *dalbergæ.*
              - b^6. Palpi yellow at base .... *punctata* ♀.
              - c^6. Palpi dark at base .... *casigneta* ab.
            - b^5. Forewing with oblique maculate band from apex to middle of inner margin .... 1192. *obliquivitta.*
            - c^5. Forewing with curved subterminal series of spots from costa before apex ....1194. *flavens.*
        - b^3. Wings almost entirely suffused with fuscous black ....1193. *venosa.*
      - b^2. Forewing orange ....1171. *flavalis.*
    - b^1. Abdomen crimson above.
      - a^2. Forewing orange tinged with crimson.
        - a^3. Forewing with the veins not scarlet ...1184. *rubitincta.*
        - b^3. Forewing with the veins scarlet ....1177. *erythrophleps.*
      - b^2. Forewing buff or yellowish white.
        - a^3. Forewing with black fascia on base of costa......................................1181. *comma.*
        - b^3. Forewing without black fascia on base of costa.

        - *a^4*. Forewing yellowish white.
            - *a^5*. Patagia without black stripes ......1165. *stigmata.*
            - *b^5*. Patagia with black stripes ....1218. *leopardina.*
        - *b^4*. Forewing buff.
            - *a^5*. Palpi crimson at base ....1172. *obliqua.*
            - *b^5*. Palpi dark at base ....1179. *casigneta.*
- *b*. Hindwing orange or yellow.
    - *a^1*. Forewing with series of black spots.
- *a^2*. Forewing yellowish white ....1159. *multiguttata.*
- *b^2*. Forewing buff.............. ....1167. *gopara.*
    - *b^1*. Forewing with black point in upper angle of cell.
        - *a^2*. Forewing with some postmedial points... *metaxantha.*
        - *b^2*. Forewing without postmedial points ......1169. *bimaculata.*
- *c*. Hindwing crimson or strongly tinged with crimson.
    - *a^1*. Hindwing with postmedial black band.
        - *a^2*. Forewing with black stripe below median nervure ....1203*a*. *bretaudiaui.*
        - *b^2*. Forewing without black stripe below median nervure ....1203. *perornata.*
    - *b^1*. Hindwing without postmedial black band.
        - *a^2*. Forewing without medial series of spots or maculate band.
            - *a^3*. Forewing with dentate black subterminal line......................................1164. *dentilinea.*
            - *b^3*. Forewing without dentate black subterminal line .... *obliqua* ab. *confusa.*
        - *b^2*. Forewing with two medial series of spots ....1195. *biseriata.*
        - *c^2*. Forewing with medial maculate band forking towards costa.........................1198. *eximia.*

C. Forewing brown buff to red-brown.

- *a*. Antennæ black.
    - *a^1*. Hindwing crimson or strongly tinged with crimson.
        - *a^2*. Forewing with antemedial black point on costa .... *obliqua* ab. *todara* ♂
        - *b^2*. Forewing without antemedial black point on costa.
            - *a^3*. Forewing with postmedial maculate black line.
                - *a^4*. Antennæ with the shaft black above ....1173. *montana.*

b^4. Antennæ with the shaft white above ....1175*a*. *albicornis.*
b^3. Forewing with postmedial series of well separated spots .... *castanea* ♀.
b^1. Hindwing buff.
a^2. Forewing with ante and postmedial scarlet lines with series of black points on them ....1176. *rubilinea.*
b^2. Forewing without scarlet lines.
a^3. Forewing with the veins not streaked with black ....1196. *sordidescens.*
b^3. Forewing with the veins streaked with black..1217. *tigrina.*
c^1. Hindwing black-brown ....1175. *castanea* ♂.
b. Antennæ whitish .... - ....1174. *strigulata.*

D. Forewing grey, grey-brown or blackish.
a. Forewing without series of white spots.
a^1. Abdomen brown ....1186. *fuscipennis.*
b^1. Abdomen crimson above ....1197. *sikkimensis.*
b. Forewing with series of white spots.
a^1. Hindwing with the ground-color white......1213. *fulvohirta.*
b^1. Hindwing with the ground-color pale yellow...1227. *impleta.*

1160. DIACRISIA LUBRICIPEDA, Linn. Syst. Nat., I., p. 505 (1758).

Bombyx lubricipeda alba, Hüfn. Berl. Mag., II., p. 412 (1766).

Phalæna lepus, Retz. Gen. Spec. Ins., p. 37 (1783).

Bombyx menthrasti, Esp. Schmett., III., p. 334, pl. 66, ff. 6—10 (1786). Hübn Eur. Schmett., II., ff. 152-153. Godt. Lép. Fr., IV., p. 362, pl. 37, ff. 5-6. Steph. Ill. Brit. Ent. Haust., II., p. 75, pl. 16, f. 3.

Bombyx mendica, Rossi. Faun. Etrur., II., p. 174 (1790).

Phalæna erminea, Marsh. Trans. Linn., Soc., I., p. 78, pl. 1, f. 1 (1491).

Chelonia luxerii, Godt. Lép. Fr., IV., p. 360, pl. 37, f. 4 (1822).

Spilosoma sangaica, Wlk., XXXI, 294 (1864). Butl. Ill. Het. B. M., III., p. 5, pl. 42, f. 5.

Habitat.—EUROPE; AMERICA; W. SIBERIA, Altai; E. SIBERIA, AMUR; JAPAN; COREA; CHINA; PUNJAB, MURREE. *Exp.* 34·46 mill.

1163. DIACRISIA PUNCTATA, insert (syn.) 1168 *Spilosoma ummera.*

1192. DIACRISIA OBLIQUIVITTA, insert (syn.) 1170 *Spilosoma jucundum.*

1171. DIACRISIA FLAVALIS, insert (syn.) *Spilosoma lativitta*, Moore P. Z. S. 1865, p. 809.

1165. DIACRISIA STIGMATA, insert (syn.) 1182 *Spilosoma lacteatum.*

1218. DIACRISIA LEOPARDINA, insert (syn.) *Ardices liturata*, Wlk. Char. Lep. Het., p. 12 (1869).

1172. DIACRISIA OBLIQUA, Wlk., III., 679 (1855) ♂ nec. ♀.

Spilosoma todara, Moore P. Z. S., 1872, p. 574.
Spilarctia nydia, Butl. Cist. Ent., II., p. 41 (1875), *id.* Ill. Het. B. M., V., p. 32, pl. 85, f. 12.
„ *ione*, Butl. Cist. Ent., II., p. 41 (1875), *id.* Ill. Het. B. M., III., p. 6, pl. 42, f. 6.
„ *confusa*, Butl. Cist. Ent., II., p. 42 (1875), *id.* Ill. Het. B. M., V., p. 33, pl. 85, f. 13.
„ *mollicula*, Butl. A.M.N.H., (4), XX., p. 395 (1877), *id.* Ill. Het. B.M., III., p. 6, pl. 42, f. 7.
Spilosoma mandarina, Moore A.M.N.H., (4), XX., p. 88 (1877).
„ *howqua*, Moore, A.M.N.H., (4) XX., p. 88 (1877).
Spilactia howra, Moore Lep. Atk., p. 40 (1879).
„ *dalbergiæ*, Moore P. Z. S. (1888), p. 394. Butl. Ill. Het. B. M., VII., p. 28, pl. 122, f. 2.
Spilarctia bifascia, Hmpsn. Ill. Het. B. M., VIII., p. 55, pl. 140, f. 21 (1891).
Spilosama bisecta, Leech Trans. Ent. Soc., 1899, p. 148.

Differs from *D. casigneta* in having the palpi crimson at base.

Ab. 1 *dalbergiæ*. Abdomen of female orange-yellow...... Kangra.

Ab. 2 *confusa*. Hindwing above wholly, and sometimes the forewing above, tinged with crimson .... Bombay, Travancore, Burma.

Ab. 3 *bifascia*. Forewing with the series of spots more complete; underside with black fascia in and below cell and two postmedial bands .... Nilgiris.

Ab. 4 *todara*. Head, thorax and forewing of male strongly tinged with red-brown, the hindwing with crimson. Female: abdomen orange above; wings whitish ochreous with the black markings reduced .... Nilgiris.

Habitat.—JAPAN; COREA; CHINA; INDIA; BURMA. *Exp.* ♂ 42—58, ♀ 50—66 mill.

1179. DIACRISIA CASIGNETA del. *confusa*, *howqua*, *nydia*, *howra*.

Ab. 1 abdomen orange-yellow above.

Habitat.—W. CHINA; N.-W. HIMALAYAS; TIBET; SIKHIM; *Exp.* ♂ 46, ♀ 52—62 mill.

1167*a*. DIACRISIA METAXANTHA, Hmpsn. Cat. Lep. Phal. B. M., III., p. 293, pl. XLV., f. 14.

♀. Head and thorax ochreous white; head tinged with yellow; palpi black, yellow below; antennæ black; tegulæ and patagia with black points; fore coxæ with black spots; legs striped with black above; abdomen orange above with dorsal black spots on three medial segments. Forewing ochreous white with black point in upper angle of cell; postmedial black points above veins 6 and 4 and on one side below vein 3; two subapical points and two points on termen above middle. Hindwing orange with slight black point in end of cell and postmedial point below costa. Underside of forewing suffused with orange to beyond the cell, except on costal area ; hindwing with the apical area whitish.

Habitat.—Burma, Myingyan. *Exp.* 50 mill.

1169. Diacrisia bimaculata insert (syn.) 1191 *Thyrgorina discalis.*

1173. Diacrisia montana insert (syn.) 1178 *Spilosoma brunneum.*

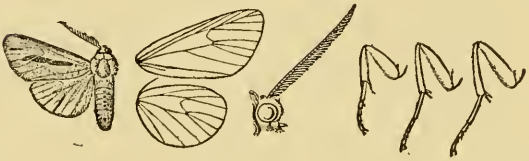
1196. Diacrisia sordidescens, Hmpsn. Cat. Lep. Phal. B. M., III., p. 304, pl. XLVI., f. 2 (1901) = *Spilosoma sordida,* Moore. nec. Hübn.

1174. Diacrisia strigatula, insert (syn.) *Chelonia cervina* Wllgrn. Wien. Ent. Mon., IV, p. 162 (1864).

Genus Amsacta. *Type.*

Amsacta, Wlk., IV., 804 (1855).. *marginalis.*

Proboscis aborted, minute ; palpi porrect to just beyond the frons and fringed below with long hair ; frons usually clothed with rough hair ; fore tibiæ with more or less developed curved claw on inner side and short, claw on outer ; hind tibiæ with one pair of spurs. Forewing with vein 3 from close to angle of cell ; 4·5 from angle ; 6 from upper angle ; 7·8·9·10 stalked ; 11 from cell. Hindwing, with veins 3·4 from angle of cell ; 5 from just above angle ; 6·7 from upper angle or shortly stalked ; 8 from middle of cell.



Amsacta lineola ♂ $\frac{1}{1}$

Sect. I. Antennæ of male bipectinate.

A. Forewing with well-defined crimson fascia on costa .... 1237. *insolata.*

B. Forewing with the crimson costal fascia very slight or absent.. *lineola.*

1239. *Creatonatus emittens* insert Amsacta lineola, Fabr. Ent. Syst. 3, 1, p. 465 (1793), which has precedence, and *Spilosoma strigata,* Wlk. Char. Lép. Het., p. 10 (1869).

Sect. II. Antennæ of male serrate.

A. Tegulæ edged with scarlet or abnormally with orange.

a. Hindwing with the termen yellow................ 1234. *flavimargo.*

b. Hindwing with the termen not yellow .... 1233. *collaris.*

B. Tegulæ not edged with scarlet or orange.

a. Forewing with the ground-color white .... 1232. *moorei.*

b. Forewing with the ground-color pale brown... 1238. *albistriga.*

1238. Amsacta albistriga.

Larva 1·3″. Head prominent, glabrous red ; body pale red-brown irrorated with very small black spots ; dorsal and lateral series of white spots in the sutures between the somites, each somite with a yellowish red band with two small dorsal and eight lateral tubercles of paler red on each with tufts of reddish hair arising from them; legs red, claspers pale red. Food-plants almost anything. (W. H. Campbell.)

Genus CREATONOTUS. *Type.*

Creatonotus, Hübn. Verz., p. 169 (1827) .... *gangis.*
Amphissa, Wlk., III., 684 (1855) .... *transiens.*
Phissama, Moore Lep. E. I. C., p. 362 (1859) .... *transiens.*

A. Abdomen crimson above .... *gangis.*
B. Abdomen orange above ....1242. *transiens.*

1231. CREATONOTUS *interruptus*, insert *Phalana* GANGIS, Linn. Amœn. Acad. VI., p. 410 (1764), which has precedence.

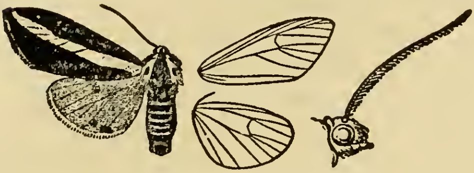
Genus ESTIGMENE. *Type.*

Estigmene, Hübn. Verz., p. 184 (1827)............................ *acræa.*
Phaos, Wlk., III., 627 (1855).. *interfixa.*
Leucarctia, Pack. Proc. Ent. Soc. Philad., III., p. 124 (1864) *acræa.*
Epilacydes, Butl. Cist. Ent. II., p. 27 (1875) .... *simulans.*
Nyaca, Moore Lep. Atk., p. 43 (1879) .... *florescens.*
Nayaea, Moore Lep. Atk., p. 43 (1879)........................ ..... *imbuta.*
Rajendra, Moore Lep. Atk., p. 43 (1879) .... *biguttata.*

Sect. I. (*Estigmene*). Antennæ of male bipectinate with moderate branches.
A. Abdomen dorsally crimson.
a. Hindwing with the ground-color yellow ...1215. *imbuta.*
b. Hindwing with the ground-color white.......1214. *florescens.*
B. Abdomen dorsally orange ....1216. *quadriramosa.*

Sect. II. (*Rajendra*) Antennæ of male serrate.
A. Forewing with the ground-color blackish.
a. Forewing with maculate white patches .... *ceylonensis.*
b. Forewing with white fascia.
a¹. Forewing with the white fascia bent below end of cell, then running to apex.
a². Forewing with the upper edge of the fascia slightly excised beyond lower angle of cell .... *irregularis.*
b². Forewing with the upper edge of the fascia not excised beyond the cell ...... *perrotteti.*
b¹. Forewing with the fascia regularly curved to apex..1219. *vittata.*
c. Forewing black with hardly a trace of fascia...1221. *nigricans.*
B. Forewing with the ground-color white.
a. Forewing mostly suffused with black............1236. *negrita.*
b. Forewing not suffused with black..................1235. *lactinea.*

1220*a*. ESTIGMENE CEYLONENSIS, Hmpsn. Cat. Lep. Phal. B. M. iii., p. 347, pl. xlvii, f. 9 (1901).



Estigmene vittata ♂ 1/1.

♀. Head and thorax dark-brown; palpi crimson at base; vertex of head white with brown spots; tegulæ white with brown spots and slightly edged with crimson; patagia with the lower half white with brown spots on shoulders; femora whitish towards base, crimson above; abdomen crimson above with dorsal, lateral, and sublateral series of brown spots, the ventral surface white with brown bands on terminal segments. Forewing dark-brown, with irregular white marks at base and small pink marks on inner margin, the basal marks conjoined to two irregular white antemedial conjoined spots extending from middle of cell to vein 1; two conjoined, curved, postmedial bands from lower end of cell to vein 1, with a small spot below them on inner margin and another above their outer extremity; points below middle of costa and on discocellulars; two postmedial points from costa and three obliquely placed from just before apex; a curved series of six spots on terminial area between veins 6 and 1, and some points on termen. Hindwing crimson; the costal area brown to beyond middle, with white point at middle and conjoined to spots at middle and end of cell; a subterminal bar from costa to vein 5; a spot on vein 2, and a terminal spot on vein 1.

Habitat—CEYLON, Hambantota. *Exp.* 32 mill.

1220*b*. ESTIGMENE IRREGULARIS, Moore Lep. Ceyl., II., p. 72, pl. 107, f. 2 (1882).

♂ Head and thorax black-brown; basal joint of antennæ pink; pinkish white fasciæ meeting on vertex of head, thence diverging on tegulæ and patagia, which last have black spots; femora crimson above; abdomen crimson above with dorsal series of short black bands, the ventral surface black. Forewing black with white fascia from base below the cell, its lower edge excised at middle, at vein 2 bent upwards to apex, its edges waved and emitting a small tooth at lower angle of cell. Hindwing pale crimson, the costal area black; a black discoidal spot; a subterminal band from costa to vein 5, a spot on vein 2 and a terminal spot on vein 1.

Habitat.—CEYLON. *Exp.* 32-36 mill.

1220. *Alphæa biguttata*, insert ESTIGMENE PERROTTETI, Guér. Icon. R. Amin. Ins. p. 514 (1844), which has precedence and del. *Rajendra irregularis* and *Spilosoma lativitta.*

1235. ESTIGMENE LACTINEA, insert (syn.) *Rhodogastria frederici*, Kirby, Cat. Het., p. 223 (1892).

Genus PERICALLIA.

	Type.
Pericallia, Hübn. Verz., p. 182 (1827)…………………………	*matronula.*
Plerctes, Led. Verh. Zool.-bot. Ges. Wien. II., p. 77 (1853)…	*matronula.*
Alope, Wlk. III. 619 (1855) …………………………………	*ricini.*
Areas, Wlk. III. 658 (1855) …………………………………	*galactina.*

Satara. Wlk. XXXI. 320 (1864) .... *distinguenda.*
Arctioneura, Feld. Reis. Nov., p. 2 (1874), non descr............ *æquata.*
Meringocera, Feld. Reis. Nov., p. 6 (1874)........................ *distinguenda.*
Tatargina, Butl. Trans. Ent. Soc. 1877, p. 366 .... *picta.*
Pangora, Moore, Lep. Atk., p. 42 (1879) .... *distorta.*
Melanareas, Butl. Ill. Het. B. M., VII, p. 29 (1899) .... *imperialis.*

Proboscis aborted, minute; palpi porrect to just or well beyond the frons; head and thorax smoothly scaled; tibiæ with the spurs short. Forewing with vein 3 from before angle of cell; 5 from above angle, or abnormally 4·5 shortly stalked; 6 from upper angle; 7. 8. 9. 10 stalked; 11 from cell. Hindwing with veins 3 and 5 from near angle of cell; 6·7 from upper angle; 8 from middle of cell.

Sect. I. (*Alope.*) Antennæ of male bipectinate with moderate branches, of female serrate.

A. Hindwing crimson or yellow ....1206. *ricina.*
B. Hindwing pale brownish......................................1207. *transversa.*

Sect. II. (*Areas.*) Antennæ of male bipectinate with very short branches.

A. Abdomen dorsally crimson or tinged with scarlet.
  a. Forewing with the ground-color scarlet ....1278. *picta.*
  b. Forewing with the ground-color not scarlet.
    a^1. Hindwing crimson.
      a^2. Forewing with double oblique series of spots or maculate band from lower angle of cell to inner margin ....1224. *sipahi.*
      b^2. Forewing with irregular white fascia from base to beyond the cell.
        a^3. Forewing with the fascia continued obliquely to termen below apex ....1223. *pannosa.*
        b^2. Forewing with the fascia joined by a band from costa before apex...........................1222. *dentata.*
    b^1. Hindwing yellow, often partly suffused with crimson.
      a^2. Forewing with white fascia in cell and submedian interspace ....1229. *imperialis.*
      b^2. Forewing with white spots in cell and submedial interspace ....1228. *galactina.*
      c^2. Forewing with narrow oblique medial fuscous band...1183. *melanopsis.*
B. Abdomen orange above.
  a. Forewing with postmedial white band arising from costa well before apex ....1226. *tripartita.*
  b. Forewing with oblique band from apex..................1225. *obliquifascia.*

1228. PERICALIA GALACTINA, insert *Areas cana.* Druce.

A. M. N. H. (7) iii., p. 234 (1899), a form from Sumatra with the hindwing wholly suffused with scarlet.

Sect. III. (*Æthalida*) Antennæ of male ciliated.

A. Vertex of thorax with dark stripes.
  a. Forewing with, usually complete, postmedial white band ....1209. *erosa.*
  b. Forewing with irregular postmedial, usually conjoined, white patches on costal and inner areas .... 1212. *matherana.*
B. Vertex of thorax with dark spots .... 1210. *distorta.*

1212. Pericallia matherana insert 1211 *Pangora rubelliana* which is the local race of it from Canara, Nilgiris, and Travancore with the yellow replaced by scarlet.

Genus Euarctia.

Type.

Carcinopyga, Feld., Reis. Nov. p. 2 (1874), non. descr. Hmpsn. Moths Ind., III., p. 492 (1896) .... *lichenigera.*

Euarctia, Staud. Stett. Ent. Zeit XLVIII., p. 79 (1887) ...... *proserpina.*

1254. Euarctia lichenigera.

Genus Arctia.

Proboscis aborted, minute ; palpi porrect to just beyond the frons ; antennæ of male bipectinate with moderate branches, of female serrate ; head, thorax and base of abdomen dorsally clothed with woolly hair ; tibiæ with the spurs short. Forewing broad, vein 3 from near angle of cell ; 5 from just above angle ; 6 from just below upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 free. Hindwing with vein 3 from near angle of cell ; 5 from just above angle ; 6·7 from upper angle ; 8 from middle of cell.

A. Antennæ with the shaft white above......................... *caia.*
B. Antennæ with the shaft black above except sometimes at extremity.. *tibetica.*

1202. Arctia caia, Linn., Syst. Nat. 1, p. 500 (1758) Hübn. Eur. Schmett II. ff. 130-131.

Phalæna erinacea, Retz. Gen. Spec. Ins., p. 36 (1783).

Arctia caja var. *wiskotti*, Staud. Hor. Ent. Ross xiv., p. 333 (1878).

„ *orientalis*, Moore, A. M. N. H. (5), I., p. 230 (1878).

Habitat.—Europe ; Armenia ; N.-W. Himalayas ; Khasis.

Subsp. 1 *americana* Harr. Rep. Ins. Mass, p. 246 (1841).

Tegulæ with a broad white band in front.

Habitat.—W. Siberia, Altai ; E. Siberia, Amur ; Japan ; Alaska ; Canada, Br. Columbia ; U. S. A., N. E. States.

Subsp. 2 *Utahensis*, H. Edw. Ent. Am. II., p. 166 (1887).

Head and tegulæ crimson, the latter with a broad white band in front ; abdomen scarlet ; hindwing yellow.

Habitat.—U. S. A., Utah, Colorado.

1204. Arctia, tibetica insert (syn) 1201 A. *sultadra.*

The type is a female with the white markings of forewings reduced to a few points ; hindwing with the subterminal spots conjoined into a band connected with the base by streaks on costa and veins 2 and 1 ; some spots on apical half of termen. A variety has the hindwing yellow.

A. intercalaris is a distinct species.

1205. ARCTIA PARVULA is from Cape Coloney, the locality Himalayas is erroneous.

Genus BAROA.

	Type.
Baroa, Moore, P. Z. S. 1878, p. 28	*punctivaga.*

1307*a*. BAROA VATALA.

Genus UTETHEISA.

1280. UTETHEISA ELATA, Fabr=*venusta* Hübn., is from Madagascar, Mauritius and Johanna. I ; the localities Sikhim and Sumatra for the species are erroneous.

UTETHEISA CRUENTATA, Butl., is from Mauritius, and the locality Sikhim for the species is erroneous.

Sect. I. Antennæ of male bipectinate with very short branches.

1279*a*. UTETHEISA ANTENNATA Swinh. A. M. N. H. (6) XII., p. 215 (1893).

♂ Head and thorax yellowish white ; palpi at tips, antennæ, spots on vertex of head, tegulæ, patagia, pro-,meso-and metathorax black ; legs striped with black ; abdomen white, the anal tuft tinged with ochreous. Forewing yellowish white ; a subbasal black spot on costa, followed by crimson spots on costa and above vein 1 ; an antemedial series of five black spots, angled below the cell, followed by crimson spots on costa and above vein 1 ; a curved medial series of black spots conjoined from costa to below cell, followed by crimson spots on costa, at origin of vein 2 and above vein 1 ; the postmedial black line strongly bent outwards in cell to discocellulars and below the cell broken up into spots, with a crimson spot beyond it at origin of vein 3, and black spots above veins 2, 4 and 6, followed by two curved series of irregular marks conjoined into blotches ; three black streaks below costa towards apex ; a crimson subapical spot and a series of black spots on termen and cilia. Hindwing white with terminal black band rather broad at apex, emitting a short streak above vein 5 and narrowing to a point at tornus.

Habitat.—NICOBARS. *Exp.* 36 mill.

Sect. II. Antennæ of male ciliated or minutely serrate.

1279. UTETHEISA PULCHELLA.

Genus SECUSIO.

1272. SECUSIO STRIGATA.

Genus AXIOPŒNA.

1255. AXIOPŒNAMAURA.

Genus RHODOGASTRIA.

	Type.
Rhodogastria, Hübn. Verz ; p. 172 (1827)	*astreas.*

1256. RHODOGASTRIA ASTREAS.

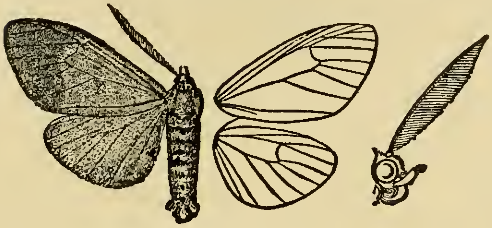
Genus Migoplastis.

Sect. I. *(Dondera)* Hindwing of male with the termen strongly excised between vein 4 and tornus; antennæ with the branches moderate.

1260. Migoplastis alba.

Sect. II. (*Migoplastis*). Hindwing of male with the termen not excised; antennæ with the branches long.

1258. Migoplastis correcta.



Migoplastis correcta ♂ $\frac{1}{1}$.

Genus Paraplastis.

Type.

Paraplastis, Hmpsn. Cat. Lep. Phal. B. M. III., p. 507 (1901)... *hampsoni.*

Proboscis fully developed; palpi upturned, the 2nd joint reaching vertex of head, the 3rd somewhat porrect; frons with a slight tuft of hair; antennæ bipectinate with moderate branches in both sexes; tibiæ with the spurs short. Forewing with vein 5 from well before angle of cell; 5 from just above angle; 6 from upper angle; 7·8 and 9·10 stalked; 11 from cell. Hindwing with vein 3 from well before angle of cell; 5 from well above angle; 6·7 stalked; 8 from middle of cell; male with the termen strongly excised towards tornus, the inner margin folded over below; the terminal area between veins 6 and 1 on upper side clothed with rough scales.

1259. Paraplastis hampsoni.

1230. Areas arginalis belongs to the genus Callimorpha. *Hypsidæ.*

1244. Leucopardus tigrina belongs to the *Noctvidæ.*

1245. Camptoloma binotata belongs to the *Noctvidæ.*

The genus Sebastia, Kirby Cat. Lep. Het., p. 383 (1892) = *Moorea* Hmpsn. Moths Ind. II., p. 32 (1894), belongs to the *Hypsidæ.*

The genera Calpenia and Callimorpha belong to the *Hypsidæ.*

DESCRIPTION OF SIXTY-EIGHT NEW SHELLS FROM THE PERSIAN GULF, GULF OF OMAN, AND NORTH ARABIAN SEA, DREDGED BY MR. F. W. TOWNSEND, OF THE INDO-EUROPEAN TELEGRAPH SERVICE, 1901—1903.

By James Cosmo Melvill, M.A., F.L.S., F.Z.S., and Robert Standen,
Assistant Keeper, Manchester Museum.

Part II. Plates C, D.

(*Reproduced from the Annals and Magazine of Natural History, Ser. 7, Vol. XII.*)

Continued from page 98 *of this Volume.*

SYRNOLA MUSSANDAMICA, sp. n. (Pl. C. fig. 1.)

S. testa parva, candida, nitida, polita, semipellucida ; anfractibus duodecim, quorum duo apicales heterostrophi, bulbosi, cæteris apud suturas haud profunde canaliculatis, nitidis, politis, ultimo longitudine penultimum et antepenultimum anfractum exæquante ; apertura ovata, labro haud effuso, tenui ; columella obscure uniplicata.

Long. 5·50, lat. 1·50 mm. (sp. min.) ; long. 7, lat. 2 mm. (sp. maj.).

Hab. Gulf of Oman, Mussandam, 47 fathoms.

A shining, white, polished shell, somewhat excavate at the sutures, twelve-whorled, of which the five lowest are much the same girth. The apical whorls are heterostrophe, in common with all of the Pyramidellidæ. There is no *Syrnola* very near this in the North-Indian fauna ; indeed, it seems to impinge closely on *Eulimella.*

MORMULA PERSARUM, sp. n. (Pl. C. fig. 2.)

M. testa pergracili, attenuato-fusiformi, ochraceo-brunnea, tenui ; anfractibus 12, quorum apicalis heterostrophus, lævis, albovitreus, cæteris ventricosulis, apud suturas impressis, arcte longitudinaliter costatis ; costis obtusis, crassis interstitiis spiraliter liratis, liris supra sæpe evanidis, obscure undique infrasuturas ad medium univel bi-albizonatis, ultimo anfractu infra peripheriam ad basim planato, simpliciter spiralilirato, anfractibus interdum varicosis ; apertura rotundo-ovata, labro tenui, dorsaliter varicoso, albo-stramineo vel brunneo ; columella alba, recta.

Long. 12·50, lat. (ad aperturam) 3·50 mm.

Hab. Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

Allied to *M. Macandreæ*, A. Ad., but with more regular whorls and ribs, the varices being fewer and less pronounced. The colour also is more uniform, being of a warm fuscous chestnut, and the outer lip not denticled within. A remarkably elegant shell.

ACTÆOPYRAMIS LÆTITIA *, sp. n. (Pl. C. fig. 3.)

A. testa parva, oblongo-fusiformi, alba, nitidiuscula, solida ; anfractibus 5—6 quorum apicalis heterostrophus, lævis, vitreus, cæteris apud suturas gradatulis pulcherrime cancellatis et decussatis, costis ad juncturas sulcorum spiralium nitidis, gemmulatis ; apertura ovata, labro paullulum incrassato ; columella fortiter uniplicata.

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* *Lætitia*, delight, gladness.

Long. 3, lat. 1 mm.

Hab. Persian Gulf, Mussandam, 47 fathoms.

Of the same character as *A. granulata*, A. Ad., from the Philippines, but only half the size (3 as against 6 mm.).

There appears to be a close connexion between certain of this genus and some included at present in *Miralda*, A. Ad. It is often hard to draw any precise lines of demarcation between these genera.

ACTÆPYRAMIS BREVICULA, sp. n. (Pl. C. fig. 4.)

A. testa minutissima, abbreviata, alba, compressiuscula, solida; anfractibus quatuor, quorum apicalis heterostrophus, vitreus, lævis, cæteris suturis gradatulis, longitudinaliter crassicostulatis, spiraliter undique rudiliratis; apertura ovata, apud basim paullum incrassata; columella uniplicata.

Long. 1·75, lat. 1 mm.

Hab. Persian Gulf, Sheikh Shuaib I., 15 fathoms.

Very minute, but characterized by its compressed abbreviate form and rude sculpture, the whorls all gradately angled at the upper part. The figure hardly shows the ribs sufficiently prominently, and there is no decussation or granulation to speak of.

PYRGULINA MANORÆ (Melv.). (Pl. C. fig. 5.)

Turbonilla (*Pyrgostelis*) *manoræ*, Melv. Mem. Manch. Soc. vol. xliii. (1898) no. 4, p. 23, pl. i., fig. 22.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

We have caused this species to be again figured on a highly magnified scale, the result being to decide us that it should be considered a *Pyrgulina*, allied to *Edgarii*, Melv., and *interstriata*, Souv., in spite of the apparent absence of the columellar plait. The original specimens came from off Manora Point, Karachi, where they were plentifully dredged at a slight depth by Mr. Townsend.

SCALA (CONSTANTIA) INTERTEXTA, sp. n. (Pl. C. fig. 6.)

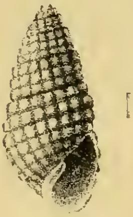
M. testa gracili, fusiformi, albida, delicata; anfractibus 10, quorum apicales tres parvi, vitrei, læves, cylindrici, cæteris ad suturas multum impressis pulcherrime regulariter decussatis, ad juncturas lirarum spiralium cum costulis fimbriolatis, ultimo anfractupaullum prolongato; apertura obliquiovata, labro effuso; columella paullum incrassata, simplici.

Ann. & Mag. N. Hist. Ser. 7, *Vol.* xii.

Long. 7, lat. 1·75 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Rarely has a small mollusk caused such perplexity as in the present instance. Two examples alone have occurred, but both have the apex perfect, this being non-heterostrophe, though in most other particulars the form and texture recall such pyramidelloid genera as *Mormula*, *Pyrgulina* or *Mumiola*, especially one species of the latter genus—*M. spirata*, A. Ad.—which also occurs in the same seas.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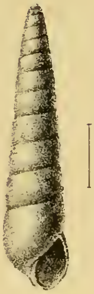
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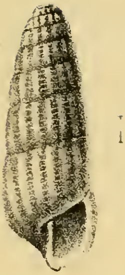
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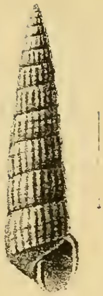
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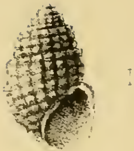
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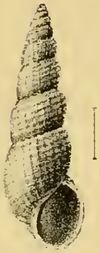
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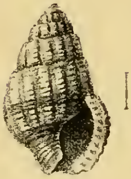
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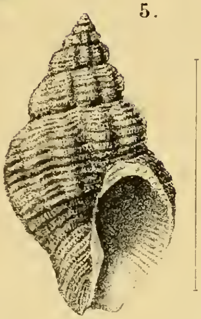
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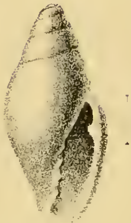
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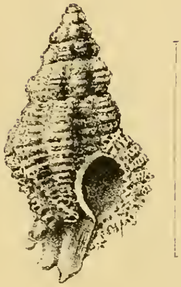
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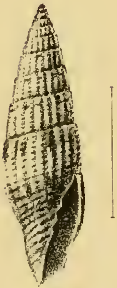
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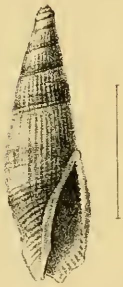
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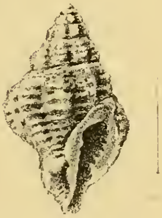
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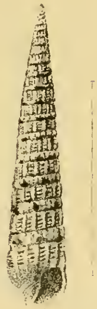
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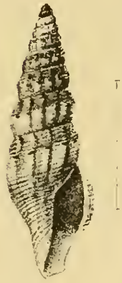
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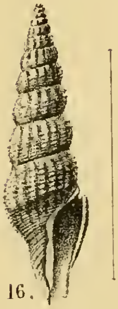
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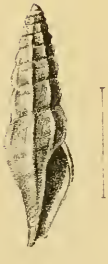
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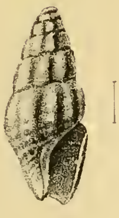
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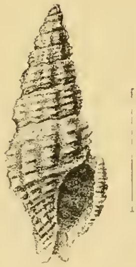
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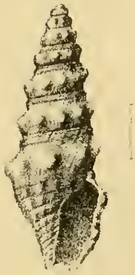
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NEW SHELLS from the Persian Gulf,
Gulf of Oman, and North Arabian Sea, dredged by
Mr. F. W. Townsend, of the Indo-European
Telegraph Service, 1901-3.

Mr. Edgar Smith considers *Cnoba egregia*, A. Ad. (which should be removed from that genus), the nearest approach to our shell, and suggests that it might, at all events provisionally, be located in *Aclis*. In lip-characters it assimilates this genus, while resembling in the decussating sculpture a *Cirsotrema*, *e.g.*, *dentiscalpium*, Wats. But perhaps the subgenus *Constantia* of *Scala* is best fitted for its reception, for it seems comparable with *C. Standeni*, Melv.[*], also from the Gulf of Oman, in more than one point.

NASSA (*ALECTRYON*) *HIMEROESSA* [†], sp. n. (Pl. C. fig. 7.)

N. testa minuta, ovata, albo-vitrea, delicata, apud basim et sæpe ad suturas pallide stramineo-suffusa, vel zonata; anfractibus 6—7, quorum 3½ apicales læves, vitrei, spiraliter unicarinati, cæteris apud suturas gradatulis, longitudinaliter arcte lævicostatis, interstitiis undique tenuiliratis; apertura fere rotunda, intus alba, labro incrassato, intus spiraliter striato; columella paullum excavata, canali brevissimo.

Long. 5, lat. 2 mm.

Hab. Gulf of Oman, at several dredging-stations in lat. 23° to 25° N., long. 57° to 59° E.

Depth ranging from 7—156 fathoms.

We at first confounded this species with *N. babylonica*, Watson, and most probably the latter does not occur in the Persian Gulf region. The present species is locally very abundant, and the fine smooth ribs, small size, subpellucid substance, and less graduate whorls will serve to distinguish it.

TRITONIDEA SOWERBYANA, sp. n. (Pl. C. fig. 8.)

T. testa ovato-fusiformi, solidula, epidermide setulosa tenuiter contecta, albida, infra, juxta suturas et infra medium anfractus ultimi castaneo-zonata; anfractibus 8—9, quorum apicales 3½ pellucidi, lævissimi, cæteris ventricosis, multum apud suturas impressis, longitudinaliter costatis, costis crassis, numerosis (ultimo anfractu apud 10), omnino spiraliter arctissime liratis; apertura rotundo-ovata, alba, labro arcuato, crassiusculo, intus albo, multicrenulato; columella recta, operculo corneo, tenui, nucleo apicali, canali brevi, paullum recurvo.

Long. 31, lat. 18 mm.

Hab. Gulf of Oman and Mekran Coast, especially between Gwadur and Jask, from 25—30 fathoms, "usually occurring with *Murex malabaricus*" (F. W. T.).

Also lat. 25° 20′ N., long. 58° 50′ E., at 90 fathoms, in company with *Latirus pagodæformis*, Melv., June 1903.

This beautiful species was first pointed out to us as distinct by Mr. G. B. Sowerby. It is near the old *Buccinum ligneum*, Reeve, = *Tritonidea cecillei*, Phil. It differs in being of stouter build, with the whorls not so scalate. There is likewise an affinity with *T. erythrostoma*, Reeve, but the lip is never coloured in the slightest degree.

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[*] Ann. & Mag. Nat. Hist. ser. 7, vol. iv, pp. 92, 93, pl. i., fig. 11.

[†] ἱμερόεις, pleasing.

METULA DAPHNELLOIDES, sp. n. (Pl. C. fig. 9.)

M. testa eleganter fusiformi, albida, delicata, mitrali; anfractibus 9, quorum 4½ apicales albo-vitrei, læves, spiraliter circumcarinati, supernis una, inferis duabus carinis præditis, cæteris apud suturas gradatulis, undique longitudinaliter pulcherrime et arcte costatis (ultimi anfractus ad 46), costis rectis, lævissimis, nitentibus, interstitiis spiraliter liratis, infra, juxta suturas, plica spirali conspicua sæpe prædita, superficie hic illic obscure stramineo maculata et depicta, ultimo anfractu (11 mm. in longitudine) gracili, paullum producto; apertura anguste oblonga, intus alba, nitida, labro paullulum effuso, crassiusculo, intus multidenticulato; columella incrassata, pernitida, simplici, basi lata.

Long. 17, lat. 5·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Two species of the genus occurred together, the above being mitriform, elegantly spindle-shaped, and white; the other is the *Buccinum metula*, Hinds, = *Metula hindsii*, Adams and Reeve, which should properly, we consider, be known by the duplicated name of *Metula metula* (Hinds). This last is larger, with coarser ribs and spiral liration, and does not possess the obscure straw maculations of the *M. daphnelloides.*

The apical whorls are well worth examination. Four or five in number, out of a total of nine in all, they are glassy vitreous white, the extreme apex mamillate, small, the next whorl with one keel, the others twice spirally carinate, the remainder of the whorls being closely longitudinally ribbed; ribs smooth and shining, white, the interstices closely spirally lirate. The mouth and lip of the new form resemble those of *Metula hindsii*, but are finer, and the inner labral denticulations more numerous.

MUREX (*OCINEBRA*) *MARJORIÆ*, sp. n. (Pl. C. fig. 10.)

M. testa solida, ovato oblonga, albo-cinerea; anfractibus sex, undique costatis, costis percrassis, varicosis, sex-fimbriato-squamatis, numero anfractum apud ultimum quinque, ad medium anguliferis, spiraliter squamato-liratis, liris rudibus, crassis; apertura rotundo-ovata, labro extus pulcherrime multifimbriato, albo vel stramineo, crasso, intus nitido, 9—10-crenulato, canali brevirostrato, fere clauso.

Long. 25, lat. 13·50 mm.

Hab. Persian Gulf, Sheikh Shuaib Island, 15 fathoms.

An exceedingly elaborately frilled species, the fimbriæ being thick and squamate, with fluted processes. In form this shell recalls *M. coccineus*, A. Ad.; the outer lip is either white or straw-coloured, the canal is shortly rostrate, almost closed. *M. cyclostoma*, Sowb., is a near ally; we have Erythræan specimens of this, but the form is much more rotund and the fimbriations in no way so elaborate.

PERISTERNIA CORALLINA, sp. n. (Pl. C. fig. 11.)

P. testa solida, parva, ovato-fusiformi, cinereo-albescente; anfractibus 6, apicali lævi, simplici, cæteris longitudinaliter crassicostatis, costis paucis, in ultimo apud 7, undique spiraliter rudiliratis; apertura anguste ovata, pallide punicea vel carnea, labro intus denticulato, margine columellari paullum reflexo; columella quadriplicata, canali brevi, recurvo.

Alt. 13, lat. 9 mm.

Hab. Persian Gulf, Gulf of Oman, near Maskat, 10 fathoms.

A somewhat solid, small, but well-grown *Peristernia* unlike any species known to us, being superficially similar to a *Coralliophila*; indeed, as suggested by the specific name, we should imagine it would be found ultimately inhabiting corals. The surface is chalky-ash, longitudinally rudely ribbed, crossed by equally coarse spirals; mouth pale pink, ovate, outer lip thickened, seven-denticled within, columella four-plaited.

MITRA (*COSTELLARIA*) *DIACONALIS**, sp. n. (Pl. C. fig. 12.)

M. testa fusiformi, solidula, albo-straminea, apicem versus attenuata; anfractibus 12, quorum apicalestres fusco-hyalini, perlæves, cæteris apud suturas paullum gradatis, arcte longitudinaliter costatis, costis lævissimis, albis, nitidis, interstitiis spiraliter sulculosis, nitentibus, undique hic illic stramineo vel ochraceo, præcipue juxta suturas et apud peripheriam maculatis et infra, depictis; apertura anguste oblonga, intus striata, ochracea, labro tenuir paullum effuso; columella quadriplicata.

Long. 13, lat. 4·25 mm.

Hab. Persian Gulf, Sheikh Shuaib Island, at 15 fathoms, among coral-sand.

A *Costellaria* allied to *M. scitula*, Ad., which, however, possesses the whorls more scalate and with darker maculations and shading; it is, moreover, a smaller species. To *M. impressa*, Reeve, known to us only by a figure, there is a resemblance: this shell, however, is of a uniform dark hue, and the ribs seem more incrassate. The number of longitudinal costæ in our species on the body-whorl is from 26 to 28.

MARGINELLA (*GLABELLA*) *ALCHYMISTA*†, sp. n.
(Pl. C. fig. 13.)

M. testa parva, fusiformi, nitidissima, subdiaphana, delicata; anfractibus quinque, lævissimis, apud suturas paullum impressis; apertura oblonga, labro nitido, incrassato, intus supra conspicue unidentato, superficie omni dorsalite lævi; columella quadriplicata.

Var. *A. CHRYSALCHYMA*, nov.

Testa aureo-straminea, dorsaliter, cum labro, omnino rufo-suffusa, vel spiraliter bizonata.

Long. 5, lat. 2·50 mm.

Hab. Persian Gulf, Gulf of Oman, Maskat, 10—15 fathoms.

Var. *B. LEUCALCHYMA*, nov.

Testa major, omnino candida, immaculata; labrum candidum, nitens.

Long. 6, lat. 3 (sp. maj.).

Hab. Persian Gulf, Gulf of Oman, Maskat, 10—15 fathoms; also at 156 fathoms, lat. 24° 58′ N., long. 56° 54′ E., and at 205 fathoms, lat. 24° 5′ N., long. 57° 55′ E.

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* *Diaconus*, a deacon.

† *Alchymista*, an alchemist.

A very pretty, shining *Glabella*, its spire more elongate than *fusiformis*, Hinds, with which it has been hitherto confounded, and as which it is inserted in our Catalogue*. It is comparable with *M. alta*, Wats. ("Challenger" Expedition), from Cape York, N. E. Australia.

If slightly local, it is very abundant where it occurs. The colour in the var. *a* is a subdiaphanous golden brown or straw, and there is a very conspicuous suffusion just behind the outer lip of deep rufous brown, bifurcating over the labrum itself. The commoner form is var. *b*, larger as a rule, and pure milky-white throughout, very smooth and somewhat shining. In one or two examples an intermediate form seems to occur, the last whorl being here white, obscurely bizoned with two chestnut lines, or, indeed, occasionally trizoned. In fact, it is a variable species.

TEREBRA HELICHRYSUM†, sp. n. (Pl. C. fig. 14.)

T. testa gracillima, multum attenuata, aciculata, nitente; anfractibus 22, quorum 3½ apicales læves, vitrei, cæteris paullum apud suturas gradatis, læte stramineis, supra, juxta suturas, zona calosa spiraliter præditis, hic illic regulariter albo et rufo maculatis, deinde, inter costas breves, longitudinales, obtusas, nitidas, profunde interstitialiter foraminatis et sulcatis, costis anfractus ultimi ad basim evanidis; apertura ovata, parva, labro tenui, canali brevi.

Long. 24, lat. 5 mm.

Hab. Persian Gulf, Mussandam, 47 fathoms.

A most elegant species, the tumid callous zone just below the sutures delicately variegated spirally with white and pale rufous, then obtusely ribbed, the interstices, especially the upper row, being deeply pitted.

PLEUROTOMA (GEMMULA) NAVARCHUS‡, sp. n.
(Pl. B. fig. 15.)

P. testa eleganter fusiformi, solida, paullum nitente, pallide cinereobrunnea; anfractibus tredecim, quorum duo apicales nitidi, hyalini, perlæves, cæteris apud suturas impressis, ventricosulis, infra suturas spiraliter pulcherrime et arcte nodoso-cingulatis, nodulis hic illic rufo-maculatis, deinde fortiter uniliratis, simul ac infra, juxta suturas, bisulcatis, superficie intermedia lata, nitida longitudinaliter, obliquissime costulata, ultimo anfractu cæteros exæquante, infra cingulum liramque spiralem usque ad peripheriam lævi, deinde anguste sulculoso, infra usque ad basim sulculis tornatis, latioribus, liris intermediis regulariter rufo maculatis; apertura oblonga, intus planata, labro tenui, sinulato, haud profundo; columella fere recta, canali subprolongato.

Long. 64, lat. 18, apertura cum canali 28 mm. longa.

Hab. Persian Gulf, Gulf of Oman, lat. 25° 19′ N., long. 58° 10′ E., 140 fathoms.

One specimen only dredged, at the locality just given, of a superbly tornate and sculptured *Pleurotoma*, near *P. carinata*, Gray, *Kieneri*, Doumet, or

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* Proc. Zool. Soc. 1901, vol. ii., p. 425.

† ἑλίχρυσον, an everlasting, from the bright rufous spotting.

‡ ναυαρχος, an admiral.

congener, Smith, being remarkable for its regular beaded spiral zone just below the sutures of each whorl, above which are two spiral clearly-cut grooves, the middle of the upper whorls being most beautifully obliquely costulate, the costæ terminated above by a double sulcus surrounding a narrow spiral lira. The last whorl, equalling the others in size, is almost entirely grooved and spirally lirate, the liræ below being rufous-spotted. Outer lip thin, perhaps not quite fully developed, sinus well marked, but not deep ; columella somewhat straight ; canal broad and rather prolonged.

The discovery of this mollusk, the finest Gastropod yet discovered by Mr. Townsend, if we except *Conus clyptospira*, M. & S., adds another magnificent Pleurotomid to the many fine species of this family obtained in contiguous waters, during the "Investigator" Expedition chiefly (such forms as *P. symbiotes*, Wood-Mason & Alcock, *P. congener*, Smith, and *P. subcorpulenta*, Smith [*] occurring to one's recollection at once), and gives another proof of its wonderful development in Indian seas.

DRILLIA DIVES, sp. n. (Pl. C. fig. 15.)

D. testa gracili, fusiformi, delicata, albo-cinerea ; anfractibus decem, quorum tres apicales brunnei, omnino hyalini, lævissimi, cæteris apud suturas impressis, ventricosulis, longitudinaliter obliquicostatis, costis anfractum apud ultimum circa undecim, undique spiraliter striatis, supra, juxta suturas, zona spirali rufa decorata, ultimo anfractu simili modo bizonato, ad basim producto albo, nitido ; apertura oblonga, labro paullum incrassato, sinu lato, haud profundo, canali brevi.

Long. 17, lat. 5 mm.

Hab. Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

Allied to *D. clydonia*, M. & S. (Proc. Zool. Soc. 1901, vol. ii, p. 437, pl. xxiii, fig. 24), but the whorls are not angled, the colouration is quite different, and the spiral ribbing is coarser in *D. dives*.

DRILLIA PHILOTIMA [†], sp. n. (Pl. C. fig. 16.)

D. testa attenuata, fusiformi, solidula, albo-cinerea, aspera ; anfractibus 11, quorum duo apicales vitrei, fusci, cæteris ventricosulis, regulariter obliquicostatis, costis anfractus ad superos paucis, crassioribus, in ultimo et penultimo numerosis, ad quindecim, et angustioribus, brunneo tinctis, suffusis, et maculatis, transversim nodiliratis, ultimo anfractu dorsaliter juxta labrum varicoso, brunneo suffuso et zonato ; apertura oblonga, angusta, intus alba, labro paullum effuso, sinu distincto, profundo, canali lato, brevi ; columella recta.

Long. 30, lat. 8 mm.

Hab. Persian Gulf, off Bahrein Islands, 30—50 fathoms.

Only one example secured of a distinct and handsome *Drillia*, the nearest approximation to which is to be found in *D. latifasciata*, Sowb., from Japan, considered by some authors as synonymous with *D. japonica*, Lischke. There is no beading at the sutures, however, and the form is more graceful.

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[*] Ann. and Mag. Nat. Hist. ser. 6, vol. xiv, pp. 160, 161, pl. iii, figs. 4—80.

[†] φιλότιμος, honoured.

DRILLIA CONTINUA, sp. n. (Pl. C. fig. 17.)

D. testa attenuata, fusiformi, lævissima, alba, nitida ; anfractibus $10\frac{1}{2}$, quorum $1\frac{1}{2}$ apicales subvitrei, nitidi, complanati, cæteris longitudinaliter paucicostatis, costis exacte inter se continuis, lævibus, albis, infra medium delicate uniangulatis, anfractu ultimo apud basim paullum pyriformi, numero costarum ad octo ; apertura subobliqua, oblonga, intus alba, labro haud multum incrassato, sinu lato, sed non profundo.

Long. 10, lat. 3·75 mm.

Hab. Persian Gulf, Mussandam, 47 fathoms.

Akin to *D. opalus*, Reeve, and conspicuous for its exactly continuous longitudinal ribs, those of whorl succeeding whorl descending in a perfectly straight line to the base. These whorls are slightly once-angled beyond the centre. The whole surface is white, with a slight ochreous tinge, and smooth.

DRILLIA GRANATELLA, sp. n. (Pl. C. fig. 18.)

D. testa parva, læte punicea, solida, nitida, fusiformi ; anfractibus 6, duobus apicalibus perlævibus, puniceis, hic illic albo suffusis, cæteris crassicostatis, costis paucis, lævibus, nitidis, numero ultimum apud anfractum circa 7, superficie omnino lævissima, dosaliter juxta labrum gibberula ; apertura breviter ovata, labro tenui, albo-suffuso, sinu lato, canali brevissimo.

Long. 5, lat. 1·50 mm.

Hab. Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

This little species, though so small, is, in our opinion, a *Drillia* rather than *Mangilia*, being nearly allied to the beautiful series of *Drillia—viz., disjecta*, Smith, *persica*, Smith, and *resplendens*, Melv.—peculiar to the same region. It is a remarkably smooth and shining shell, and the pomegranate-pink colour (like the fruit of *Punica granatum*, L.) seems characteristic and quite peculiar.

DRILLIA LITHORIA,[*] sp. n. (Pl. C. fig. 20.)

D. testa parva, fusiformi, pallide rufa, solidula ; anfractibus 8, quorum 2 apicales læves, vitrei, cæteris magnopere supra medium anfractum tumescentibus et spiraliter noduliferis, nodulis paucis, gemmatis, dein, anfractus apud supernos, tornatis, ultimo anfractu basim versus spiraliter paucilirato, liris pulchre et minute gemmatis ; apertura quadrato-ovata, labro tenui, sinu lato, haud profundo, canali brevi.

Long. 8, lat. 2·50 mm.

Hab. Persian Gulf, Bahrein Islands, 6 fathoms, coral-sand.

A small highly-coloured species, with conspicuous, spiral, swollen, nodulous angle just above the centre of the whorls. We cannot connect it nearly with any other species.

DRILLIA AUDAX, sp. n. (Pl. D. fig. 1.)

D. testa oblongo-fusiformi, solida, parva, albo-straminea ; anfractibus septem, quorum tribus nitidissimis, hyalinis, lævibus, apicalibus, cæteris trinis, antepenultimo quaternis, ultimo circa viginti spiralium lirarum ordinibus accinctis, ad anfractus supernos gemmulatis, supra suturas, etiam, lira spirali fortiori

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[*] λίθος, in sense of a precious stone.

decorato, omnibus his liris stramineo-ochraceis ; apertura ovato-oblonga, sinu distincto, lato, canali brevissimo, lato, margine columellari excavato.

Long. 9·25, lat. 2·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A little species of bold contour, and very distinct in both sculpture and painting of the spiral straw-coloured liræ surrounding the whorls, which are not costulate. One spiral lira, acute and prominent, is especially noticeable at the base of each whorl, just above the sutures.

A good many examples occurred in the dredging, as above, in shell-sand.

MANGILIA COMIDELEUCA [*], sp. n. (Pl. D. fig. 5.)

M. testa parva, angulari, fusiformi, omnino albida, solida ; anfractibus 9, quorum duo apicales læves, globulares, vitrei, cæteris ad medium angulatis longitudinaliter paucicostatis, spiraliter undique rudiliratis, interstitiis albis labro dorsaliter multum incrassato, angulari ; apertura sinuoso-oblonga, sinu perlato, margine columellari tristriato, canali lato, brevi.

Long. 8, lat. 3 mm.

Hab. Persian Gulf, Mussandam, 47 fathoms.

Most resembling *M. spurca*, Hinds, found abundantly in the same region, but differing in colour (the new form being entirely white), in size (8 as against 14 or 15 mm.), and in greater angularity of whorl. The somewhat sinuous or trigonous aperture and very thickened peristome are the same in both species. Only one or two examples have yet occurred.

CLATHURELLA OPSIMATHES,[†] sp. n. (Pl. C. fig. 19.)

C. testa oblongo-fusiformi, solidula, nitida, cinerea, albo et fusco zonata ; anfractibus 10, quorum 3 apicales, cæteris circa suturas lævibus, planatis, aliter undique longitudinaliter crassicostatis, costis paucis (numero ultimum apud anfractum 10), spiraliter pulchre superne 3-, ultimo 10-liratis (ad peripheriam albizonato), liris albo-cinereis, conspicuis, supra costas angulosis ; apertura oblonga, labro incrassato, echinulato, fusco et albo depicto, sinu lato, haud profundo ; columella recta, canali lato, brevi.

Long. 16·50, lat. 6 mm.

Hab. Persian Gulf, Sheikh Shuaib Island, 15 fathoms.

Hitherto confounded with *C.* (*Glyphostoma*) *rugosa*, Migh., a quite different species. It is a prettily sculptured and painted shell, with conspicuous beading and spiral well-cut liræ.

CLATHURELLA SYKESII, sp. n. (Pl. D. fig. 4.)

C. testa parva, perangusta, attenuato-fusiformi, albo-cinerea ; anfractibus 8—9, quorum apicales duo læves, cæteris ad suturas permultum impressis, angulosis ventricosis, longitudinaliter acuticostulatis, costis paucis, numero ultimum apud anfractum circa 9, undique spiraliter liratis, liris rudibus (in penultimo et ultimo circa 6), prominulis ; apertura ovata, labro tenui, sinu conspicuo profundo, canali longo.

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[*] κομιδῆ, altogether ; λευκός, white.

[†] ὀψιμάθης, late in being discerned.

Long. 7, lat. 2 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

We are indebted to Mr. Ernest R. Sykes for calling our attention to this curious little species, so like a *Fusus* in miniature. It is one of the narrowest *Clathurellæ* in proportion to its length yet discovered, and is wonderfully symmetrical throughout. All the examples, of which there are several, are dead, and perhaps in life there may be colouration of some kind. It is common at the above station, in company with another nearly allied *Clathurella* that we hope to describe shortly.

*CLATHURELLA QUISQUILIA**, sp. n. (Pl. D. fig. 7.)

C. testa attenuata, fusiformi, angusta, solidula, omnino albida ; anfractibus 9—10, quorum duo apicales bulbosi, læves, vitrei, cæteris paucicostatis, costis crassis, numero ultimum apud anfractum 5, spiraliter undique liris rudibus succinctis ; apertura ovato-trigona, labro incrassato, sinu lato sed non profundo ; columella fere recta, canali brevi.

Long. 7, lat. 2 mm.

Hab. Persian Gulf, Mussandam, 47 fathoms ; also Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Attenuate and narrow, thickly longitudinally ribbed, and encircled throughout with markedly coarse lirations. It did not occur at all plentifully at the above station, only three or four examples having as yet been seen.

DAPHNELLA (PLEUROTOMELLA) NEREIDUM †, sp. n. (Pl. D. fig. 2.)

D. testa ovato-oblonga, subpellucida, delicata, albo-lactea ; anfractibus 8—9, quorum 2½ vel 3 apicales pallide rufi, tenuissime decussati, cæteris ad medium, angulatis, ad suturas paullum impressis, arcte cancellatis, interstitiis quadratulis, costis lirisque transversis crystallinis, ultimo anfractu supra medium angulari, costis dorsaliter juxta labrum sæpe evanidis ; apertura anguste ovata, intus alba, labro tenui.

Long. 7, lat. 3 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A crystalline form of unusual beauty. In form this assimilates *P. filifera* Dall, but the apical whorls are not smooth, but decussate.

DAPHNELLA (*PLEUROTOMELLA*) *AMPHITRITES* ‡, sp. n. (Pl. D. fig. 3.)

D. testa ovato-cylindrica, delicata, subhyalina, albo-lactea ; anfractibus 7—8, quorum 2½ apicales albi, sub lente pulchre decussati, cæteris longitudinaliter lirato-costulatis, spiraliter liris crassioribus succinctis, ad juncturas costularum cum liris gemmulatis, nitidis, infra medium anfractus antepenultimi et penultimi duabus spiralibus liris magis conspicuis, cariniferis, simul ac in ultimo ad peripheriam ; apertura ovato-oblonga, intus hyalina, alba, labro tenui, canali brevi, paullum recurvo.

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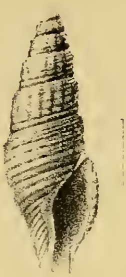
* *Quisquiliæ*, trifles.

† *Nereïdum*, of the sea-nymphs.

‡ *Amphitrite*, a sea-goddess, wife of Neptune.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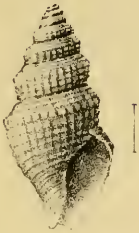
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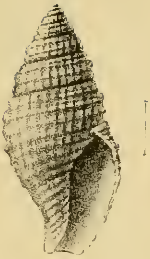
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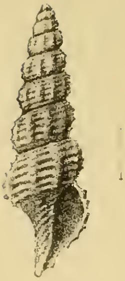
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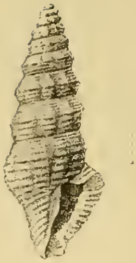
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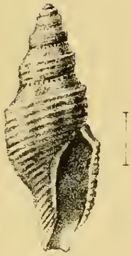
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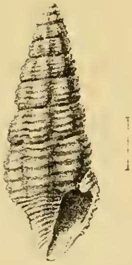
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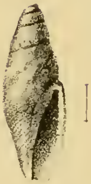
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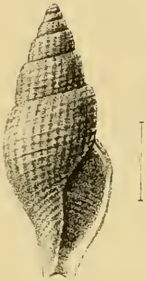
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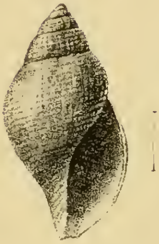
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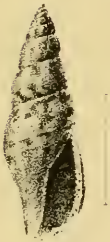
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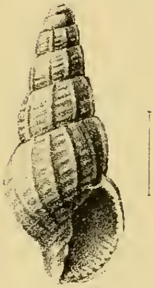
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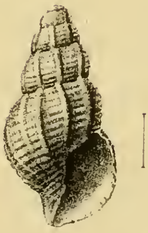
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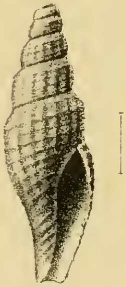
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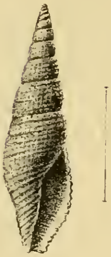
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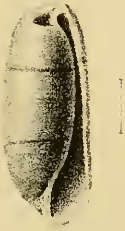
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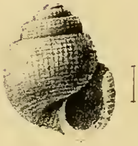
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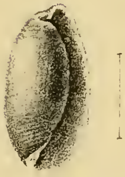
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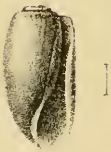
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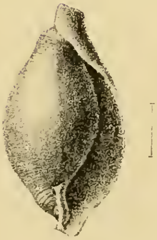
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J. Green del. et lith. Mintern Bros. imp.

NEW SHELLS from the Persian Gulf,
Gulf of Oman, and North Arabian Sea, dredged by
Mr. F. W. Townsend, of the Indo-European
Telegraph Service, 1901-3.

Long. 8, lat. 3 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

The two species *D. amphitrites* and *D. nereïdum* occur together, but we think it correct to separate them, though undoubtedly they are nearly allied. The present species is the less angular, rather larger, and of a more roundly cylindrical form.

DAPHNELLA THYGATRICA [*], sp. n. (Pl. D. fig. 6.)

D. testa parva, fusiformi, tornata, albo-straminea, longitudinalliter pallide rufo-tincta ; anfractibus 7, quorum tres apicales apice ipso lævi mamilato, duobus pulchre sub lente decussatis, cæteris spiraliter ad medium, ultimo ad peripheriam duplo-carinatis, lirisque lævibus, fortiter succinctis, ultimo anfractu ad medium, inter carinas, recto ; apertura oblonga, labro tenui, sinu obscuro, margine columellari incrassato, albo, nitido, canali lato, paullum producto.

Long. 7, lat. 2·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A small *Drillia* in miniature, looked at superficially, but the decussate apical whorls are Daphnelloid. It occurred somewhat commonly at the above station.

DAPHNELLA THIA [†], sp. n. (Pl. D. fig. 8.)

D. testa delicatissima, subpellucida, attenuato-fusiformi, albida, nitida ; anfractibus octo, quorum 3½ apicales ochro-tincti, pulchre decussati, cæteris tumidulis, liris arctis longitudinalibus spiralibusque decussatis, liris interdum pallidule stramineo-tinctis nitidulis ; apertura oblonga, labro tenui sinu lato haud profundo, canali brevi, lato, paullum producto.

Long. 9·50, lat. 3 mm.

Hab. Persian Gulf, Sheikh Shuaib Island, 15 fathoms ; Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Most delicate and beautifully closely encircled with decussating liræ, a faint, straw-coloured or golden tinge being sometimes observable on them. The specimens from the first locality mentioned are not so tumid on the body-whorl ; we cannot, however, separate them, even varietally, from the typical form from the Gulf of Oman. This differs from *D. boholensis*, Reeve, not only in the fine decussations, but in the canal being more prolonged and greater tumidity of whorls.

DAPHNELLA BUCCINULUM [‡], sp. n. (Pl. D. fig. 9.)

D. testa ovato-rotunda, bucciniformi, delicata, alba, interdum pallide ochraceo-suffusa ; anfractibus 7, quorum 3 apicales rufi vel straminei, tenuissime decussati, cæteris arcte et delicate obliqui cancellatis, ad suturas impressis, tumidis, inflatis, ultimo anfractu pyriformi ; apertura oblonga, labro tenui, sinu indistincto, margine columellari excavatulo.

Long. 7, lat. 3·75 mm.

Hab. Gulf of Oman, lat. 24° 58' N., long. 54° 56′ E., 156 fathoms.

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[*] θυγάτηρ, a daughter.

[†] θεῖος, divinely beautiful.

[‡] *Buccinulum*, dim. of *Buccinum*, from the resemblance.

An inflated Buccinoid species, very delicate and beautifully cancellate throughout, which occurred not uncommonly at the above station in company with so many other, mostly minute, but hitherto unknown, mollusks.

DAPHNELLA EPICHARTA[*], sp. n. (Pl. D. fig. 10.)

D. testa minuta, subpellucida, tenui, oblongo-fusiformi, nitida, alba vel obscure stramineo-diffusa ; anfractibus 6, quorum apicales 3 delicatissime sub lente decussati, cæteris paullum ventricosis, fere lævibus, sed irregulariter spiraliter tenuissime liratis, ultimo anfractu interdum apud medium lævi ; apertura angusta oblonga, labro fere recto, incrassato, albo, nitide, intus simplici ; calumella recta, canali brevi, sinu perobscuro.

Long, 5, lat. 1·75 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A minute but puzzling form. The sinus and other Pleurotomid characters are so slightly expressed that it might at first sight be considered an *Æsopus*, or even an *Olivella*. The delicate decussation of the apical whorls shows the true relationship. It is somewhat frequent at the above station. Some examples are almost smooth, the apical liræ being more or less obsolete.

DAPHNELLA HEDYA [†], sp. n. (Pl. D. fig. 11.)

D. testa fusiformi, pallide castaneo-brunnea, apicem versus, simul ac ad basim delicate puniceo-tincta ; anfractibus novem, quorum 3½ subhyalini, castaneo-punicei, minutissime decussati, tribus his proximis variciferis, tribus ultimis rotundatis, tumidulis, undique arctissime et pulchre decussatis, ad juncturas, gemmuliferis, gemmulis microscopicis, nitidis, supra, infra suturas, spiraliter castaneo-maculatis, ultimo anfractu dorsaliter obscure bizonato ; apertura oblonga, labro crassiusculo, intus lævi, sinu haud profundo, canali paullulum ad basim reflexo, puniceo tincto.

Long. 14, lat. 5 mm.

Hab. Persian Gulf, Sheikh Shuaib Island, 15 fathoms.

Though at first sight this little species seems to present a familiar appearance, it is really distinct from any species hitherto recognized. Compare it with *D. patula*, Rve., for instance : the chestnut markings are more or less similar, but the whole texture of the shell is distinct, the minute gemmuliferous decussation, the elegant rounded whorls, the smallish oblong aperture presenting notable points of difference.

DAPHNELLA EUPHROSYNE, sp. n. (Pl. D. fig. 12.)

D. testa attenuata, gracili, albida, tenui ; anfractibus decem, quorum quatuor apicales castaneo-suffusi, minutissime decussati, cæteris ventricosulis, undique spiraliter arcte liratis, liris gemmuliferis, nitidis, inæqualibus, numero ultimum apud anfractum tres et viginti ; apertura anguste oblonga, labro tenui, sinu haud profundo, canali apud basim producto, lato.

Long. 15, lat. 4 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

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[*] ἐπίχαρτος, pleasing.

[†] ἡδὺς, sweet.

Doubtless allied to *D. boholensis*, Reeve, but possessing two more whorls, while it is more graceful and attenuate throughout; peristome not so effuse, canal more prolonged, and spiral liration more distinct and regular. Again, it differs in its beaded liration from any form of *D. axis*, Reeve, which it resembles in form, and which also occurs in the same seas. Were it not for the absence of columellar plication, it would more than resemble a *Mitra* of the subgenus *Cancilla*. The peculiar beauty well merits for it the specific name proposed, of one of the three Graces.

CYTHARA ELEGANTISSIMA, sp. n. (Pl. D. fig. 13.)

C. testa pergracili, fusiformi, albida; anfractibus 6, quorum 2½ apicales obtusi plani, minute sculpti, cæteris supra medium tenuiter angulosis, dein rectis, undique longitudinaliter rudiliratis, liris inconspicuis, spiraliter liris crassioribus succinctis (in ultimo circa 14); apertura anguste oblonga, intus alb labro sinu lato, haud profundo, incrassato; columella fere recta, basi prolongata.

Long. 8, lat. 2·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms. Also lat. 25° 30′ N., long. 57° 30′ E., 88 fathoms, mud.

A very elegant form, as implied by the specific name, with markedly obtuse apex, probably not quite full-grown. The coarse longitudinal liræ, crossed by more distinct, but equally rough, spirals, are characteristic. Very rare. Since description, another example has been procured, with perfect thickened lip, sinus broad and shallow.

CANCELLARIA (TRIGONOSTOMA) LUSCINIA[*], sp. n. (Pl. D. figs. 14, 15.)

C. testa parva, attenuato-fusiformi, tenui, albida, vel pallide olivaceostraminea; anfractibus septem, quorum tres apicales tumidi, vitrei, perlæves, cæteris longitudinaliter irregulariter sed arcte costatis, ad suturas excavatis, costis crassiusculis, undique transversim tenuiliratis, liris tenuibus superficiem totam circumambientibus; apertura oblongo-ovata, margine columellari triplicato.

Long. 11, lat. 4 mm. (sp. maj.).

Hab. Arabian Sea, lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

This is the little species alluded to by us in our former paper as having been dredged near Bombay, as above, in April 1901. It is allied to *C. macrospira*, Ad. and Rve., but much smaller in every detail. The shell is attenuately spindle-shaped, thin, either translucent white or pale straw-olive, seven-whorled, the three uppermost whorls being glassy, globular, and swollen, the remaining three or four closely but irregularly ribbed, somewhat excavate, as are nearly all the section *Trigonostoma* of *Cancellaria*, suturally. The transverse liræ surmount the ribs and are not interrupted. The columella is thrice-plaited.

KLEINELLA SYMPIESTA[†], sp. n. (Pl. D. fig. 16.)

K. testa perforata rotundato-ovata, alba, obesa, compressa; anfractibus 5, quorum 1½ apicales vitrei, perlæves, cæteris apud suturas gradatulis, ventricosis, undique delicate decussatis, interstitiis quadratulis ; apertura ovato-lunari, labro paullum incrassato, margine minute crenulato, supra late excavato.

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[*] *Luscinia*, a nightingale.

[†] συμπίεστος, compressed.

Long. 5, lat. 3·50 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Only two species, of which the best known is *K. cancellaris*, A. Ad., from Corea and Japan, have hitherto been described of this genus, and to these we venture now to add a third. Undoubtedly, they have a close family affinity to each other : the *K. sympiesta* may be known by its particularly obese and compressed form and tumid body-whorl ; the umbilicus is deep and the outer lip minutely crenulate on the margin.

Judging alone from conchological grounds, the animal being absolutely unknown, we should assign to this genus a place near *Actæon*, Montft., and not, as suggested by some authors, consider it one of an outlying group of the Pyramidellidæ. Indeed, were it not for the total absence of the columellar plicæ, we should regard it as a member of the genus just mentioned (*Actæon*).

CYLICHNA (MNESTIA) BIZONA, A. Adams. (Pl. D. fig. 17.)

Bulla (*Cylichna*) *bizona*, A. Ad. in Sowerby, Thes. Conch. pt. 11, vol. ii., p. 595, pl. cxxv., fig. 148.

Hab. Gulf of Oman, Maskat, 15 fathoms.

A large local form (alt. 7, diam. 3 mm.), which we figure, as contrasting with the Chinese examples in the Cumingian collection and with others. It is a species of wide distribution, being reported from China, Singapore, Fiji, and Torres Straits.

CYLICHNA JECORALIS, sp. n. (Pl. D. fig. 18.)

C. testa oblongo-cylindrica, delicata, apud basim paullum effusa, apice imperforato, plicato, subhyalina, superficie lævi, nitida, antice posticeque spiraliter striata, pallide livido-olivacea ; apertura pyriformi, supra angusta, intus cinerea, labro paullum effuso, tenui ; columella obscurissime plicata.

Alt. 11, diam. 5 mm.

Hab. Persian Gulf, Gulf of Oman, Maskat, 15 fathoms.

Without a knowledge of the anatomy of these small species of Tectibranchs, it is often mere guesswork assigning them to generic positions. This species, however, seems best located in *Cylichna*, in our opinion. It is a delicate, moderate-sized species, of a peculiar hepatic tint, this suggesting the proposed specific name.

RETUSA OMANENSIS, sp. n. (Pl. D. fig. 19.)

R. testa parva, cylindrica, albo-lactea, subhyalina, tenui, supra, truncatulo apice fere immerso ; anfractibus 3, supra excavatulis, marginibus apud suturas acutis, prominulis, superficie omni spiraliter sub lente delicatissime striata ; apertura postice latiore, oblonga, antice angusta, labro recto, ad basim rotundata ; columella obscure uniplicata, margine paullum incrassato.

Alt. 4, diam. 1·75 mm.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

A most delicate and minute species, of the same character as *Utriculus complanatus*, Watson, from Papua ("Challenger" Rep. xv., p. 650, pl. xlviii, fig. 9), but that species is longitudinally striate. We follow Pilsbry (Man. Conch. xv, p. 203) in the nomenclature, and would refer to his reasons for the substitution of *Retusa*, Brown, 1827, for the more familiar *Utriculus*, Brown (in parte), 1844, *non* Schumacher, 1817.

ATYS FLAVOVIRENS, sp. n. (Pl. D. fig. 20.)

A. testa ovata, in medio tumida, utrinque producta, tenuissima, subdiaphana, pallide flavo-virente, apud medium lævi, nitida, antice, simul ac postice, spiraliter paucistriata, apice plicato, labro tenui, paullum effuso; apertura anguste lunari; columella uniplicata.

Alt. 7, diam. 3 mm. (sp. maj.).

Hab. Gulf of Oman, Maskat, 15 fathoms.

Allied to *A. tortuosa*, A. Ad., from the Philippines and Torres Straits; the shell is smaller, and more green than yellow-tinged. Mouth narrower, the anterior as well as the posterior striæ being fewer and less pronounced. Many examples.

*MATHILDA CARYSTIA**, sp. n.

M. testa gracili, fusiformi, eleganter attenuata, brunnea, brunneonigra, vel, imprimis, castanea; anfractibus 12—13, quorum apicalis heterostrophus, pervitreus, globularis, cæteris apud suturas impressis, binis præcipuis lævibus carinis præditis, sexvel septem ultimis ter minoribus asperis, omnibus acutis, prominulis, interstitiis quadratulis, ultimo anfractu 9-carinato, quorum tres circa peripheriam maxime conspicui; apertura fere rotunda, labro tenui, crenulato; columella alba, crassiuscula, recta, nitida.

Long. 12, lat. 3 mm.

Hab. Persian Gulf, Koweit, 10 fathoms, mud and sand.

A very select species, having the vitreous heterostrophe apex so characteristic of the genus; turritelloid in shape, elegantly attenuate, the upper whorls with two principle carinæ and three lesser keels, the lowest whorl nine-keeled, of which three, at the periphery, are the most important. The quadrated spaces at the interstices, and liræ extending longitudinally over the lower carinæ, have a beautiful effect as regards the sculpture. The colour is either pale chestnut, dark chestnut, brown, or blackish. The two other species from the same region, *M. gracillima* and *zmitampis*† (of which the latter has since occurred in the Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms), differ in size, colour (both being white), and, in the case of *M. gracillima*, in squareness of aperture. A general family likeness, however, pervades all the members of this exquisite genus. This new species, and also the next, will be figured subsequently.

SOLARIUM (TORINIA) ADMIRANDUM, sp. n.

S. testa parva, depresso-discoidali, late perspective umbilicata, alba, delicata; anfractibus quatuor, quorum apicalis profunde submersus, huic proximus vitreus, tumescens, lævis, cæteris depressis, pulcherrime sculpturatis, juxta suturas spiraliter carinatis, dein tribus liris minoribus, cum carina fortissima spirali exterius succincta, inter quam et peripheriam lira minore interposita, peripheria quam maxime acuta, pulchre et minute echinulata, ultimo subtus ad basim imprimis sulco forti, dein duabus vel tribus carinis spiralibus conspicuis prædito, carina supra umbilicum, sicut peripheriali, pulchre sculpturata et echinulata, umbilico ipso simili modo echinulis, minoribus decorato ; apertura rotunda, peristomate tenui, carina peripheriali ad medium conspicua. Alt. 1·20, diam. 3 mm.

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* *κάρυον καρύστιον*, from the chestnut colour.

† Proc. Zool. Soc. 1901, vol. ii, pp. 379, 380, pl. xxii, figs. 18, 19.

Hab. Gulf of Oman, lat. 24° 58′ N., long. 56° 54′ E., 156 fathoms.

Among very numerous examples of *S. homalaxis*, Melv., which appears frequent from Bombay northwards, three specimens occurred of a far more select form, which is now described. Its sculpture is most elaborate, the very acutely keeled periphery, bordered (as is the inner basal keel) surrounding the umbilicus with short mucronate crenulations, is most distinctive. The two species of *Homalaxis* found in the same dredging, and described earlier in this paper, are of a similar texture and bizarre sculpture, especially as regards the aforesaid carinal ornamentation.

With regard to the Mollusca treated of in this paper, it will be well to state that four types are in the collection of Mr. E. R. Sykes, *viz.*, *Rissoina registomoides*, *Eulima* 10-*gyra*, *Fluxina Dalliana*, and *Clathurella Sykesii*. All the rest, with co-types of the last two just mentioned, will be placed in the British Museum (Natural History).

EXPLANATION OF THE PLATES.

PLATE A.

Fig. 1. *Emarginula undulata.*
Fig. 2. —— *Camilla.*
Fig. 3. *Cyclostrema henjamense.*
Fig. 4. —— *supremum.*
Fig. 5. —— *annellarium.*
Fig. 6. —— *prominulum.*
Fig. 7. —— *euchilopteron.*
Fig. 8. *Liotia romalea.*
Fig. 9. —— *echinacantha.*
Fig. 10. *Enida persica.*
Fig. 11. *Euchelus Townsendianus.*
Fig. 12. *Solariella zacalles.*
Fig. 13. *Calliostoma thrincoma.*
Fig. 14. *Leptothyra rubens.*
Fig. 15. *Trichotropis pulcherrima.*
Fig. 16. *Solarium* (*Torinia*) *cerdaleum.*

PLATE B.

Fig. 1. *Solarium abyssorum.*
Fig. 2. *Fluxina Dalliana.*

Fig. 3. *Homalaxis rotula-catharinea.*
Fig. 4. —— *cornu-Ammonis.*
Fig. 5. *Cerithium verecundum.*
Fig. 6. *Scissurella ætheria.*
Fig. 7. *Fossarus* (*Coathouyia*) *unicarinalis.*
Fig. 8. *Adeorbis axiotimus.*
Fig. 9. *Erato recondita.*
Fig. 10. ————, var. *haplochila.*
Fig. 11. *Eulima decagyra.*
Fig. 12. *Rissoina isosceles.*
Fig. 13. —— (*Zebina*) *registomoides.*
Fig. 14. *Eulimella carmanica.*
Fig. 15. *Pleurotoma* (*Gemmula*) *navarchus.*

PLATE C.

Fig. 1. *Syrnola mussandamica.*
Fig. 2. *Mormula persarum.*
Fig. 3. *Actæopyramis lætitia.*
Fig. 4. ——*brevicula.*
Fig. 5. *Pyrgulina manoræ,* Melv., var.
Fig. 6. *Scala (Constantia) intertexta.*
Fig. 7. *Nassa (Alectryon) himeroessa.*
Fig. 8. *Tritonidea Sowerbyana.*
Fig. 9. *Metula daphnelloides.*
Fig. 10. *Murex (Ocinebra) Marjoriæ.*
Fig. 11. *Peristernia corallina.*
Fig. 12. *Mitra (Costellaria) diaconalis.*
Fig. 13. *Marginella (Glabella) alchymista.*
Fig. 14. *Terebra helichrysum.*
Fig. 15. *Drillia dives.*
Fig. 16. —— *philotima.*
Fig. 17. —— *continua.*
Fig. 18. —— *granatella.*
Fig. 19. *Clathurella opsimathes.*
Fig. 20. *Drillia lithoria.*

PLATE D.

Fig. 1. *Drillia audax.*
Fig. 2. *Daphnella nereïdum.*
Fig. 3. —— *Amphitrites.*
Fig. 4. *Clathurella Sykesii.*
Fig. 5. *Mangilia comideleuca.*
Fig. 6. *Daphnella thygatrica.*
Fig. 7. *Clathurella quisquilia.*
Fig. 8. *Daphnella thia.*

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Fig. 9. *Daphnella buccinulum.*
Fig. 10. —— *epicharta.*
Fig. 11. —— *hedya.*
Fig. 12. —— *Euphrosyne.*
Fig. 13. *Cythara elegantissima.*
Figs. 14, 15. *Cancellaria (Trigonostoma) luscinia.*
Fig. 16. *Kleinella sympiesta.*
Fig. 17. *Cylichna (Mnestia) bizona,* A. Ad., var.
Fig. 18. —— *jecoralis.*
Fig. 19. *Retusa omanensis.*
Fig. 20. *Atys flavovirens.*

DESCRIPTIONS OF TWO NEW SNAKES FROM UPPER BURMA.

(*With a Plate.*)

By G. A. Boulenger, F.R.S., V.P.Z.S.

(*Read before the Bombay Natural History Society on March* 1905.)

A small series of Reptiles collected in the neighbourhood of Mogok, Upper Burma, by my friend Mr. Herbert Hampton, and presented by him to the British Museum, contains besides examples of little known species, such as *Acanthosaura kakhienensis*, Anders. (*Caloes feœ*, Blgr.), *Dinodon septentrionalis*, Gthr., and *Amblycephalus andersonii*, Blgr., two snakes which are evidently new to Science, and of which I have much pleasure in sending descriptions to the Bombay Natural History Society.

Oligodon herberti. (Pl. fig. 1).

Nasal undivided ; portion of rostral seen from above nearly or quite as long as its distance from the frontal ; no internasals, the rostral wedged in between the nasals and in contact with the præfrontals ; frontal longer than its distance from the end of the snout, shorter than the parietals ; no loreal, the præfrontal in contact with the second labial ; one præ and one postocular ; temporals 1 + 2 ; six upper labials, third and fourth entering the eye ; three or four lower labials in contact with the anterior chin-shields, which are longer than the posterior. Scales in 13 rows. Ventrals 189-190 ; anal divided ; subcaudals 37-40. Dark grey above, with four dark brown longitudinal bands, the median pair seperated by a yellowish brown vertebral stripe, which, anteriorly, may be broken up into elongate, hexagonal, black-edged spots ; an oblique yellowish streak on each side of the nape, coverging towards its fellow on the occiput ; head dark brown, with two yellow spots on the sides, one in front of the eye, the other behind ; orange-red below, almost every other ventral shield with a black square spot at the outer end.

Total length 560 millimetres ; tail 80.

Two specimens, male (v. 190 ; c. 40), and female (v. 189 ; c. 37).

This very well characterized species differs from all those with which I am acquainted in having only 13 rows of scales, a character ascribed to the insufficiently described *O. dorsale*, Berthold, in which the anal is single. *O. brevicauda*, Gthr., is the only other species known to lack the internasal shields.

AMBLYCEPHALUS HAMPTONI.

(Pl. fig. 2).

Rostral a little broader than deep ; internasals three-fifths the length of the præfrontals, which enter the eye ; frontal slightly longer than broad, longer than its distance from the end of the snout, two-thirds the length of the parietals ; supraocular about half the width of the frontal ; loreal nearly twice as deep as long ; two præoculars and one postocular, the latter produced to below the eye, which is thus excluded from the labials by a narrow rim ; temporals short, 1 + 2 ; seven or eight upper labials, last longest ; three pairs of large chin-shields. Scales in 15 rows, dorsals feebly keeled. Ventrals 202 ; anal entire ; subcaudals 96. Body strongly compressed. Pale brown above, with numerous blackish bars interrupted on the middle of the back ; two black longitudinal streaks on the back of the head and nape ; sides of head and lower parts yellow ; a few black dots on the belly and under the tail.

Total length 555 millimetres ; tail 150.

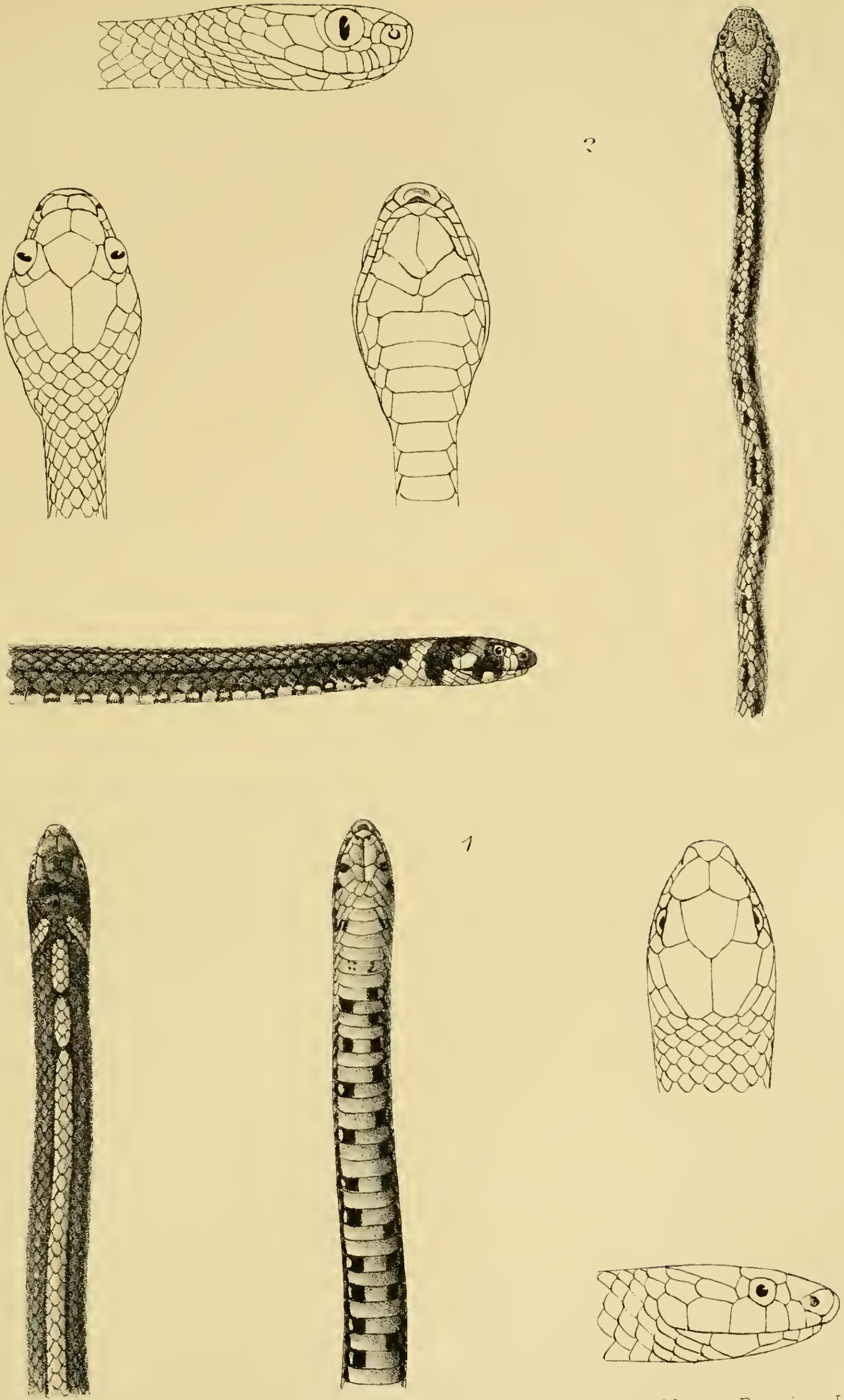
A single male specimen.

This species appears to be most nearly related to the imperfectly described *A. modestus*, Theob., from Pegu.

EXPLANATION OF THE PLATE.

Fig. 1. *Oligodon herberti*, upper, lower, and side views of head and anterior part of body, and enlarged upper and side views of head.

Fig. 2. *Amblycephalus hamptoni*, upper view of head and anterior part of body, and enlarged upper, lower, and side views of head.



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NEW SNAKES FROM BURMA.

1. *Oligodon herberti.* 2. *Amblycephalus hamptoni.*

SOME NEW MOSQUITOES FROM CEYLON.

BY

F. V. Theobald, M.A.,

Communicated by E. Ernest Green, F. E. S.

(With Plates A & B.)

A small collection of mosquitoes taken by Mr. E. E. Green in Ceylon included four new genera and eight new species which are described here. Besides these, a single ♀ of Dönitz's *Anopheles deceptor*; ♀'s of *Myzorhynchus barbirostris*, Van der Wulp; ♀'s of Giles *Stegomyia pseudotœniata*, also ♀ *Tœniorhynchus ager*, Giles; *Culex tigripes*, Grandpre; *Mansonia annulifera*, Theobald—all new to the Island.

The *Anopheles deceptor* shows, on examination of the scales, to belong to Meigen's genus *Anopheles* as recently restricted by me.

Some ♂ and ♀ *Myzomyia rossii*, Giles, were very pale varieties. No other species in the collection had any peculiarities.

Two of the new genera *Lophoceraomyia* and *Rachionotomya* are of particular interest on account of their peculiar structure, the latter having a large scutellar spine, the former a strange modification of the verticillate hairs which appear to form definite organs; what purpose they serve is at present unknown.

Genus MEGARHINUS, Rob. Desvoidy.

Essai sur les tribu des Culicides, Mem. Soc. d'Hist. de Paris, III, p. 412 (1827).

Megarhinus minimus, nov. sp. (fig. 1).

Thorax shiny black with metallic bronzy scales, some blue and green scales at the base of the wings; pleuræ silvery white; prothoracic lobes blue. Head bronzy brown with metallic green and blue border around the eyes. Palpi long, acuminate and thin, deep violet; proboscis deep violet. Abdomen metallic violet and purple with creamy lateral spots, the apical segment coppery red; basal lobes of genitalia deep brown. Legs brown with violet reflections, creamy at the base of the femora and below the femora.

♂ Head black with deep bronzy brown flat scales behind and over most of the surface with sometimes metallic reflections and with metallic green and blue scales around the eyes. Two black chætæ project forwards between the eyes and one on each side of the median pair. Antennæ brown, the basal joint large and globular, black with a grey sheen at the sides. Clypeus black; proboscis metallic violet. Palpi long, thin, metallic violet, acuminate; composed of four segments, the acuminate apical one slightly longer than the penultimate segment, the penultimate and the preceding one nearly equal (fig. 1 *b*); on the penultimate segment are a few short black spines.

Thorax shiny black clothed with metallic brassy flat scales of two sizes, mostly spindle-shaped, with a patch of pale blue ones at the base of the wings and a few rather short black spines; just behind the root of the wings are some large flat apple-green scales. Prothoracic lobes clothed with flat mauve and pale blue scales; scutellum black with small flat brassy, green and coppery scales on the large mid lobe, dusky over on the lateral lobes; border-bristles brown; metanotum dark-brown; pleuræ yellowish-brown with dense flat snowy white scales. Abdomen expanding apically, metallic deep blue and violet basally and extending to the last few apical segments which are more brilliant, their bases with green and blue scales, their apical portions with violet and coppery red, the apical segment and to some extent the basal lobes of the genitalia with fiery red and coppery scales; no caudal tuft (fig. 1 *c*), but the two last segments have short, dense, black lateral bristles; on the first segment is a large creamy lateral patch, there are also more or less prominent basal creamy lateral patches to the other segments; venter creamy yellow, except for the black apex.

Legs uniformly black with metallic violet scales; fore ungues unequal, the larger uniserrated, of the hind legs also unequal, and apparently simple, three of the hind small, much curved, equal and simple.

Wings (fig. 1*a*) small, scales brown, those at the base showing violet reflections; the first sub-marginal cell so minute that it is scarcely perceptible to the naked eye; second posterior cell fairly large and broad about half the length of its stem; the third long vein carried well past the cross-veins as a scaled vein; supernumerary cross-vein about three times its own length nearer the apex of the wing than the mid, mid cross-vein small, joining the posterior cross-vein which is about five times the length of the mid. Halteres dull ochreous.

Length of body 6 mm; of palpi 4 mm.

Habitat: Yatiyantota, Ceylon.

Time of capture: March, (1902).

Observations.—Described from a single perfect ♂. Whether it will come in *Megarhinus* or *Toxorhynchites* it is not possible to say, but I fancy it is a true *Megarhinus*. Its small size will at once separate it from all known members of the two genera. It is also peculiar in having spines or bristles in the place of a caudal fan and in the very minute first fork-cell. The abdomen shows all manner of metallic and color reflections.

Genus STEGOMYIA, Theobald.

Mono. Culicid I., p. 283 (1901.)

STEGOMYIA ANNULIROSTRIS, nov. sp.

Head creamy grey ; proboscis black with a median white area. Thorax brown with creamy white scales scattered over it, most dense in front ; pleuræ brown with white puncta. Abdomen deep brown, the third, fourth and fifth segments with basal median triangular white spots, apical segments yellow-scaled, lateral white median spots to all the segments. Legs with very narrow pale basal bands to some of the fore and mid tarsi, broader ones on the hind pair ; knee spots snowy white, also base of hind femora.

♀ Head covered with flat silky creamy grey scales which have a rusty brown hue at the sides when seen in some lights. Proboscis black with a clear median white band. Palpi short, black-scaled, the apex apparently truncated. Antennæ brown, basal segment testaceous.

Thorax black clothed with rather long, thick silky white and creamy narrow curved scales, most densely in front and rather broader scales in front of the scutellum ; golden-brown bristles project over the roots of the wings ; scutellum covered with small flat white scales and with golden-brown border bristles ; metanotum reddish-brown ; pleuræ brown with patches of white scales. Abdomen deep blackish-brown, the third, fourth and fifth segments with a basal white median spot, somewhat triangular on the fourth and fifth segments, the apical segments with yellowish and creamy scales, except the extreme apex which is black, no markings dorsally on the first and second segment, each segment with lateral median white spots ; border-bristles small pale golden.

Legs brown with some basal white bands: on the fore legs there is a narrow band at the base of the metatarsus and first two tarsi ; the base of the femora paler than the remainder ; in the mid legs traces of similar pale bands and a white prominent knee spot, on the venter the whole foot is shiny creamy white ; in the hind legs the greater part of the femora are white, the apex only dark and the white basal bands on the metatarsi and first three tarsi broader than on the other feet ; fore and mid ungues equal, uniserrated, the hind equal and simple.

Wings with brown scales, fork-cells short, upper border darker than the rest of the wing ; first sub-marginal longer and slightly narrower than the second posterior cell, its stem nearly as long as the cell, stem of the second posterior cell as long as the cell ; posterior cross-vein some distance from the mid cross-vein. Lateral vein scales rather long. Halteres with pale stem and fuscous knot.

Length 4 mm.

Habitat : Peradeniya, Ceylon.

Time of capture : January, (1902).

Observations.—Described from a single ♀.

It differs from all known Stegomyias in having a banded proboscis and in thoracic ornamentation. The mid tarsi look all dull white in some lights ; this is due, I fancy, to the neutral surface of the segments being pale-scaled. The thorax is slightly rubbed, but is evidently entirely covered with the pale scales which now and again present the same rusty hue as that seen in the head scales.

STEGOMYIA MEDIOPUNCTATA, nov. sp.

Head with a snowy-white median area, black at the sides and with a few white lateral scales ; proboscis black, unbanded ; palpi black with white apex. Thorax deep brown, the front with a broad area of large white scattered narrow-curved scales, the remainder with pale dull brown scales ; scutellum white-scaled in middle, brown laterally ; abdomen black, segments with basal median white spots. Legs deep brown, the fore and mid metatarsi and first tarsals with small white apical bands, the hind with broad white basal bands to the metatarsi and first tarsal, second tarsal all black, third nearly all white except for a minute black apex, fourth black.

♀ Head clothed with large flat scales, those on the middle snowy-white, on each side black with a few white ones on the extreme sides, a few black bristles project forwards ; clypeus black ; proboscis black ; palpi black scaled with snowy-white apical scales ; antennæ deep brown, basal segment black with a crown of snowy-white scales. Thorax deep brown covered with rather large irregular narrow-curved scales, those in the middle in front being white, those behind and at the sides pale dull brown; scutellum prominently trilobed, the median lobe with large flat white scales, the lateral lobes with large flat, dull brown scales and with brown border-bristles; pleuræ brown with patches of white scales.

Fore legs brown, a narrow pale band at the base of the metatarsus and first tarsal, the mid legs the same, only there is a distinct snowy-white knee spot; hind legs with the base and venter of femora white, the base of the metatarsi and first tarsal segment white, the second tarsal all black, the third all white but for a small black apex, last tarsal small all black.

Wings with typical brown Stegomyian scales; first sub-marginal cell longer and slightly narrower than the second posterior cell, its base slightly nearer the base of the wing, its stem about half the length of the cell; stem of the second posterior nearly as long as the cell; posterior cross-vein about twice its own length distant from the mid. Halteres with fuscous knob.

Length 3 mm.

Habitat: Peradeniya, Ceylon.

Time of capture: November (1901).

Observations.—Described from a single female in excellent condition. The curious leg banding will at once separate it from all known Stegomyias.

Genus TRICHORHYNCHUS, nov. gen.

Head clothed with small flat scales in front forming a broadish area, similar ones at the sides, narrow-curved ones over most of the median area and many narrow upright forked ones; antennæ with long segments, verticillate hairs scanty, the internodes densely hairy; palpi of ♀ rather prominent, apical segment long, slightly swollen. Thorax with narrow-curved scales, also the scutellum. Abdomen and legs normal. Wings with dense scales on the veins of the apical area, those on the first long vein and the branches of the second dense, intermediate in form between Culex and Tæniorhynchus, those on the upper branch of the fourth shorter and broader than the rest.

This genus is very marked and comes between the Stegomyian group and the true Culex. It can at once be told by the cephalic scale structure, and the densely hairy antennæ are also very characteristic.

TRICHORHYNCHUS FUSCUS, nov. sp. (fig. 2).

Head brown with a greyish border around the eyes and at the sides composed of small flat scales. Palpi, proboscis and antennæ deep brown; thorax tawny to testaceous brown; pleuræ pale ferruginous. Abdomen ferruginous to dusky brown, brighter brown beneath. Legs deep brown, paler basally; unbanded. Wings rather short, fork-cells short.

♀ Head (figs. 2, *a.* & *e.*) with small flat grey scales forming a broad border around the eyes and with similar flat scales at the sides, in the middle small dull golden narrow curved scales and fine black upright forked scales behind. Palpi (fig. 2, *g.*) short, brown, testaceous beneath; proboscis brown, the testaceous hue present as in the palpi; clypeus (fig. 2, *h.*) pale yellowish brown; antennæ (fig. 2, *d.*) brown, basal segment pale yellowish-brown, very pilose between the verticels. Thorax bright ferruginous clothed with narrow-curved mouse-colored and dull golden scales and with numerous bristles of a more or less dull hue; scutellum (fig. 2, *c.*) bright testaceous with small narrow-curved scales as on the thorax; seven border-bristles to the mid lobe, metanotum bright chestnut-brown; pleuræ pale ferruginous with frosty sheen in some lights and a few pale bristles.

Abdomen dusky brown, ferruginous brown in some lights covered with dusky brown scales and with rather short pale border-bristles; venter brighter brown.

Legs deep brown, coxæ and venter of femora paler; ungues equal and simple.

Wings rather short, the scales dense on the apical area, especially on the branches of the fork cells and on the first long vein, these scales broader than in Culex, approaching Tæniorhynchus form; fork-cells rather small, the first sub-marginal longer and very slightly narrower than the second posterior, its stem more than half the length of the cell, its base a little nearer the apex of the wing; stem of the second posterior as long as the cell; scales on the upper branch of the fourth vein rather broader than elsewhere. Posterior cross-vein nearly twice its own length distant from the mid; mid and supernumerary meet at an angle. Halteres pale, with faintly fuscous knob.

Length 5 mm.

Habitat: Peradeniya, Ceylon.

Time of capture: December (1901).

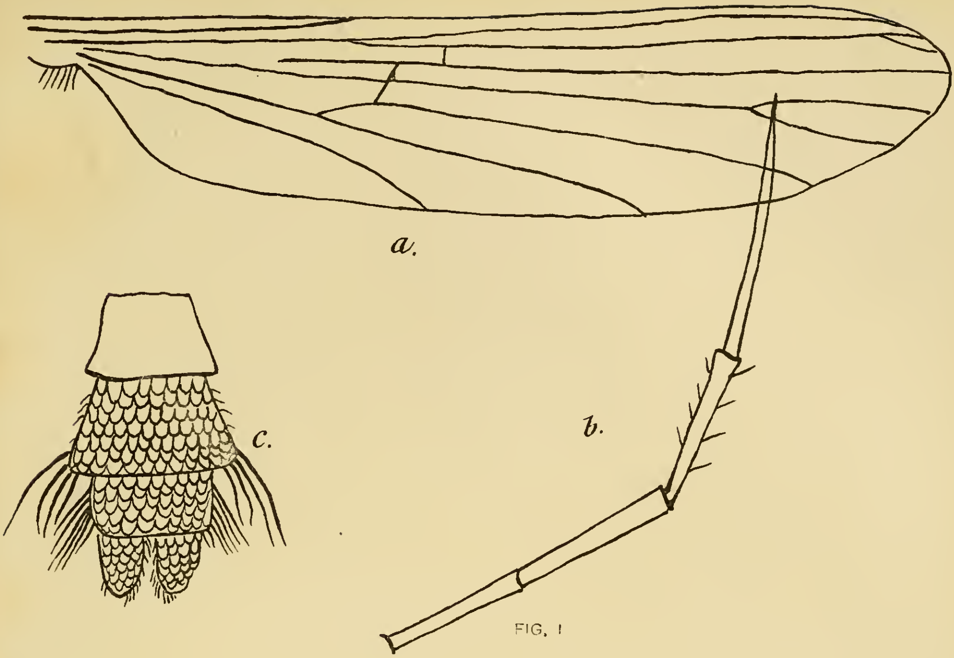


FIG. 1

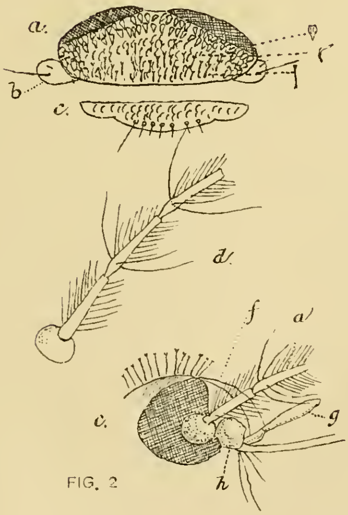


FIG. 2

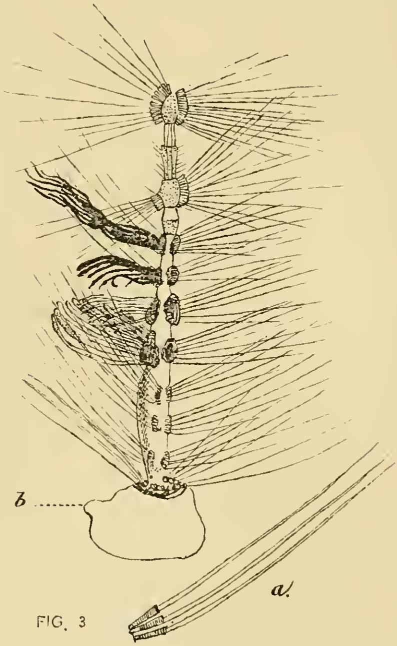


FIG. 3

CORTEZ & CO. LITH. BOMBAY.

NEW MOSQUITOES FROM CEYLON

Observations.—Described from a single ♀ in perfect condition. It is an obscure species, resembling a Culex, unless examined under the two-third power when its generic characters are at once seen both in regard to cephalic and wing scale structure.

Genus PSEUDOGRABHAMIA, nov. gen.

Head clothed with narrow-curved, upright forked and flat lateral scales. Mesothorax with narrow-curved scales; scutellum with small flat scales only on the lateral lobes, small flat ones on the mid lobe, except along the posterior border where there are narrow-curved scales; metanotum nude. Wings with rather broad cone-shaped scales especially on the basal half of the veins, thin lateral ones on the apical halves and rather broader ones on the stems of the fork-cells; fork-cells short. Male palpi with the two apical segments rather swollen, also the apex of the antipenultimate; the apical segment bluntly acuminate, both end segments with hair-tufts and also hairs on the apex of the antipenultimate segment.

This genus looks very much like *grabhamia*, but can at once be told by the scutellum having small flat scales, not all narrow curved ones as in that genus.

PSEUDOGRABHAMIA MACULATA, nov. sp.

Thorax reddish-brown with two rather indistinct small pale spots; pleuræ with silvery puncta. Abdomen with basal white bands. Legs with mottled scales and basal white bands. Wings short with small fork-cells, scales mottled. Antennæ of ♂ flaxen; palpi brown with three narrow pale bands; apical joint acuminate.

♀ Head brown with scattered greyish-white, rather broad narrow-curved scales, very small narrow-curved golden ones around the eyes and numerous black upright forked scales. Antennæ deep brown, the basal globular segment black to brown, the base of the second segment bright testaceous. Clypeus black; proboscis with deep brown, black and scattered white scales. Palpi short, with deep brown scales, except at the apex where they are white. Thorax deep brown with very small reddish golden-brown narrow curved scales nearly all directed posteriorly; ornamented with four round silvery grey spots on the mesonotum, similar colored ones just in front near the head and another spot on the front of the root of the wings and scattered grey scales in front of the scutellum; pleuræ brown with grey puncta; scutellum with small flat white scales only on the lateral lobes, small flat white ones on most of the median lobe with a few narrow-curved pale golden ones on its apical edge, with bright brown border bristles. Abdomen deep, blackish-brown with basal white bands and with short pale golden border-bristles.

Legs deep brown, the femora and tibiæ and metatarsi with scattered pale scales, the knees white, metatarsi and first three tarsi of the fore and mid legs with basal pale yellow to almost white bands, last tarsal segment all deep brown ; in the hind legs all the segments have basal white bands ; ungues of the fore and mid legs equal and uniserrated, of the hind equal and simple. Wings short with the fork-cells short, the scales mottled brown and creamy grey ; scales on the basal areas of the veins and the median paired ones cone-shaped and broad, the lateral ones on the apical halves linear and very narrow, except on the branches of the first fork-cell where they are broader ; on the stems of the fork-cells they are much broader and cone-shaped ; some of the scales are asymmetrical ; first sub-marginal cell longer and slightly narrower than the second posterior cell, its base slightly nearer the apex of the wing, its stem about the same length as the cell ; stem of the second posterior slightly longer than the cell ; posterior cross-vein not quite its own length distant from the mid cross-vein.

Length 3·8 to 4 mm.

♂ Antennæ banded brown and grey, plume hairs bright flaxen. Proboscis not mottled as in the ♀. Palpi long ; the two apical segments and the apex of the penultimate slightly swollen ; the apical segment about the same length but narrower than the penultimate, the remainder of the palps looking like one long segment, the jointing being invisible owing to the scales ; color deep brown ; creamy white scales form an apparent band at the base of the two apical segments and there is another very narrow pale band half way down the remainder of the palps ; the two apical segments have blackish plume-hairs and also both sides of the apex of the anti-penultimate segment. Legs as in the ♀ ; fore and mid ungues unequal, both uniserrated ; the hind ones simple (? equal). Wings much as in ♀.

Length 4·3 mm.

Habitat : Galgamuwa, Ceylon.

Time of capture : August (1902).

Observations.—Described from two perfect ♀'s and one ♂. The species is very marked, but unless examined microscopically might asily be placed in *Grabhamia*, from which it is separated by the small flat scutellar scales.

Genus LOPHOCERAOMYIA, nov. gen.

Head clothed with narrow-curved scales and numerous upright forked ones. Palpi short in the ♀; in the ♂ longer than the proboscis or only half its length. Proboscis swollen apically. Antennæ normal in the ♀, verticillate and pilose; in the ♂ plumose, some of the verticillate whorls modified into variously formed organs, apparently formed out of modified verticillate hairs. Thorax clothed with narrow curved scales, also the scutellum. Abdomen and legs normal. Scales on the veins on the apical area of the wings dense, the lateral vein scales broader than in Culex, those on the first long vein short and rather broad, upper costal border spiny, no lateral vein scales on the basal areas.

This genus can be easily told on the ♂ by the curious antennal organs and in both sexes by the wing scales from *Culex* which it approaches in general appearance. I am also describing two new species in this genus from New Guinea and India in the catalogue of Culicidæ in the National Museum, Budapest.

Lophoceraomyia uniformis, nov. sp. (figs. 3, 4).

Head brown with a grey border around the eyes; proboscis deep broad slightly swollen apically; palpi deep brown. Thorax tawny brown, pale at the sides; pleuræ grey, green or pale brown. Abdomen deep chocolate brown, unbanded; venter dull ochreous. Legs long deep brown, except for pale coxæ and venter of femora. Wings transparent; fork-cells small; male palpi brown, acuminate, longer than the proboscis.

♀ Head brown, clothed with narrow-curved grey scales and numerous upright black forked ones behind, becoming fewer and browner near the front, thus covering most of the grey-scaled head and giving it a brown appearance except around the eyes where the grey scales only exist; clypeus testaceous; proboscis black, swollen apically, about two-thirds the length of the whole body, labellæ testaceous; palpi thin and rather long, about one-fifth the length of the proboscis, black scaled; antennæ brown with narrow pale bands and black verticillate hairs.

Thorax shiny brown, clothed with narrow-curved tawny brown scales, which become much smaller and almost black just before the scutellum, bristles long and black, scales at the sides somewhat paler in certain lights; scutellum pale brown with small narrow-curved dark scales;

metanotum pale brown; pleuræ pale grey, dull white or pale green, almost nude. Prothoracic lobes small, nude, pale brown.

Abdomen deep rich chocolate brown to dull brown; no banding or lateral spots; border-bristles pale; venter dull ochreous.

Legs deep brown, rather long, the coxæ and bases of femora grey; ungues all equal and simple. Wings with the branches of the first sub-marginal cell and the stem with rather long scales, those on the first long vein typical, also the spiny upper costal border; other lateral vein-scales may appear linear, but when flattened are much broader than in a true Culex; fork-cells short, the first sub-marginal considerably longer and narrower than the second posterior; its base nearer the base of the wing, its stem about half the length of the cell; stem of the second posterior as long or longer than the cell; mid cross-vein longer than the supernumerary, both united, posterior cross-vein longer than the mid nearly three times its own length distant from it; fringe dark and dense.

Halteres with pale stem and fuscous knob.

Length 3·5 to 4 mm.

♂ Palpi (fig. 4) long thin, longer than the proboscis by the last and nearly half the penultimate segments, with a few spines or hairs only on the two apical segments, the two segments nearly equal, black, remainder of palpi dull yellowish-brown. Fore ungues unequal, uniserrated; hind equal and simple; mid ?

Antennal organs as figured (fig. 3 *a*, *b*.). Wings with short fork-cells, the first sub-marginal considerably longer and narrower than the second posterior; its base a little nearer the base of the wing, its stem about two-thirds the length of the cell; stem of the second posterior slightly longer than the cell; posterior cross-vein longer than the mid, sloping backwards and about two-and-a-half times its own length distant from it; with the exception of the apical portions of the veins there are no lateral vein scales, only a narrow single row of median ones. Halteres pale with fuscous knob.

Length 4 mm.

Habitat: Peradeniya, Ceylon.

Time of capture: May (1902.)

Observations.—Described from two ♂'s *and several* ♀*'s.* It generally resembles *L. fraudator*, Theobald and *L. fragilis*, Theobald, but the ♂ can at once be told by the different palpi and antennal organs.

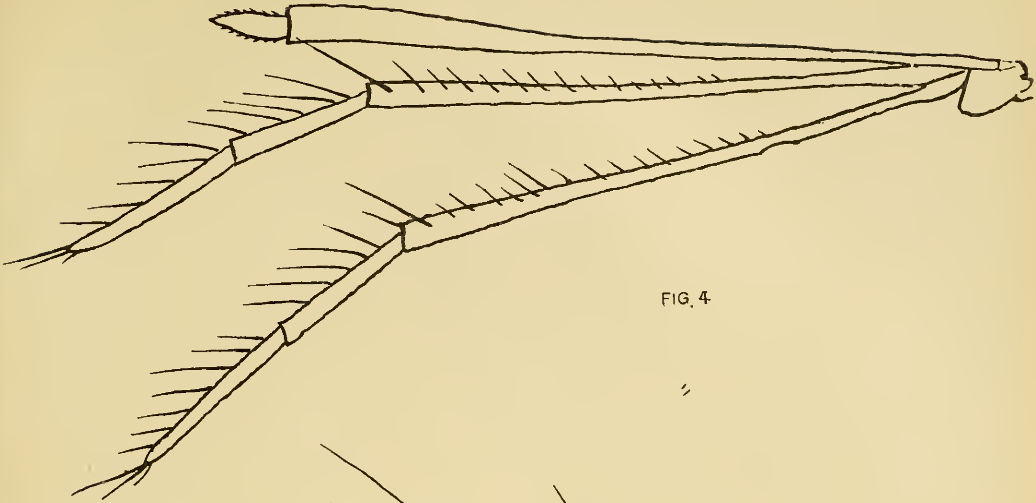


FIG. 4

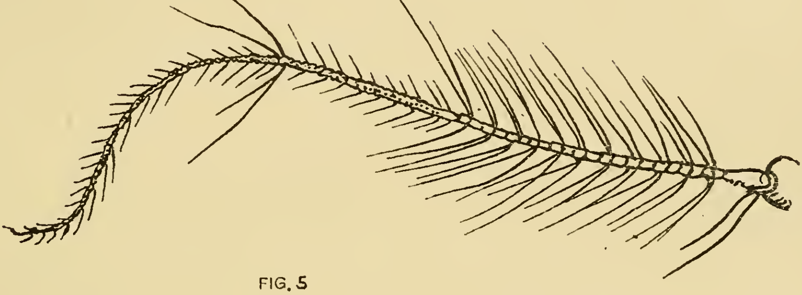


FIG. 5

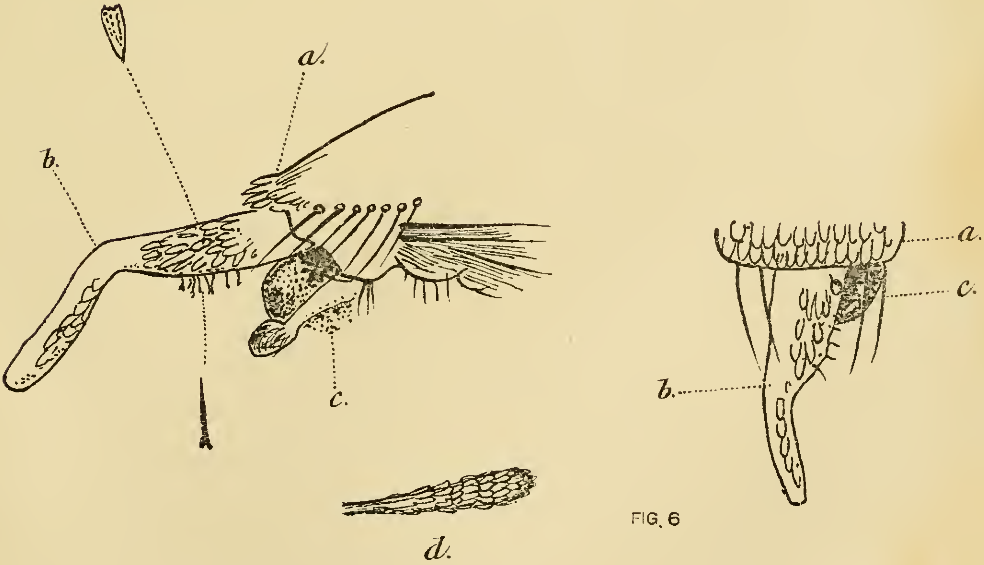


FIG. 6

NEW MOSQUITOES FROM CEYLON.

Genus WYEOMYIA, Theobald.

Mono. Culicid II, p. 267 (1901), *and III, p.* 310 (1903).

WYEOMYIA GREENII, n. sp. (fig. 5).

Thorax brown with bronzy scales; pleuræ silvery white. Abdomen black with two pure white basal bands on the apical portion and with prominent basal silvery white lateral patches, triangular in form. Proboscis rather short, black; legs black, unbanded.

♀ Head entirely clothed with large flat brown and violet scales, a few grey ones at the sides; proboscis not much more than half the length of the whole body, deep blackish brown; palpi dark-scaled with some creamy scales apically.

Thorax shiny black with large flat metallic bronzy, dull green and mauve scales; scutellum with similar flat scales of various dull metallic tints; metanotum brown with short black chætæ; pleuræ testaceous with silvery grey spots.

Abdomen black, the fifth, sixth and seventh segments with basal white bands, the sides of all the segments with basal triangular white spots, most prominent on the basal segments; the abdomen is compressed basally, depressed apically.

Legs blackish; venter of femora pale unbanded, rather thick; ungues small, equal and simple. Wings with brown scales, the lateral vein-scales linear, rather dense, first sub-marginal cell longer and narrower than the second posterior cell, its stem about two-thirds the length of the cell, stem of the second posterior as long as the cell; posterior cross-vein nearly twice its own length distant from the mid.

Length 4 mm.

♂ Head clothed with flat dusky scales; antennæ (fig. 5) brown, the lower third with the long verticillate hairs, upper two-thirds with dense short hairs only, except for one group of three or four long ones towards the middle of the short-haired area; palpi small, black-scaled; proboscis rather longer than in the ♀, black.

Thorax clothed as in the ♀; prothoracic lobes white-scaled.

Abdomen black with rich violet reflections and with basal lateral white triangular spots; apical segment expanded, basal lobes of genitalia very large, scaly and hairy. Legs brown unbanded.

Length 4 mm.

Habitat: Peradeniya, Ceylon.

Time of capture: January and February (1902).

Observations.—Described from a perfect ♂ and ♀. It is the only member of this group yet found in Ceylon. The general appearance at once separates it from all allied forms, except *Phoniomyia longirostris*, but the proboscis is shorter and not longer than the body as in that genus.

The metanotal chætæ are difficult to see, and the strange ♂ antennæ are rather contorted, so only a diagramatic figure is given.

RACHIONOTOMYIA, nov. gen.

Head clothed with flat scales only; palpi moderate sized in ♀; proboscis long, as long as the whole body; antennæ of ♀ densely pilose, hairs rather long. Palpi moderate clavate. Thorax clothed with spindle-shaped scales; scutellum drawn out into a large thick backwardly projecting spine hiding to a large extent the metanotum, on the basal area of the scutellum flat scales which also occur on the base of the wings, the spine with scales also, some flat, some on ventral surface forked. Abdomen normal, but the scales large and rather loosely applied, giving a faint rugged appearance. Wings with rather short fork-cells, median scales on the branches of the second long vein thick and dense, also on first long vein, lateral vein scales scanty, linear but broader than in *Culex*; upper costal border spiny. Legs normal. Male unknown.

This genus is very marked owing to the strange scutellar process. It is the only genus in which I have seen any marked structural peculiarity in the scutellum, all other genera having the scutellum simple (Anophelinæ and Corethrinæ) or trilobed (Culcinæ, &c).

RACHIONOTOMYIA CEYLONENSIS, nov. sp. (fig. 6).

Head brown with dull violet reflections and a grey border around the eyes; palpi, proboscis and antennæ dark brown; proboscis as long as the body. Thorax brown to testaceous brown, pleuræ bright clear brown with some silvery white scales; scutellar spine brown. Abdomen deep brown above, ochreous below, neither banded nor spotted. Legs deep brown, pale testaceous at their bases. Wings with brown scales.

♀ Head clothed with large flat scales, brown in some lights, dull violet in others, around the eyes a border of dull white or grey scales; two black bristles project forwards between the eyes and traces of others at the sides; proboscis deep brown, as long as the whole body, curved upwards; palpi deep brown; small, but prominent clavate;

antennæ deep brown with grey pubescence, and black verticillate hairs; the globular basal segment with a grey sheen.

Thorax varying from deep brown to bright testaceous brown covered with irregularly placed rather large flat spindle shaped scales of a brown or bronzy hue, in front and on the prothoracic lobes small rounded flat grey scales, over the roots of the wings some larger flat scales, pale brown, grey or dull creamy colored, those at the sides also larger and flatter; a few short brown curved bristles in front of the base of the wing and a row of long ones over the base curved backwards; scutellum (fig. 6, *a*, *b*,) deep brown, sending out a large thick tapering blunt process backwards, covered with flat scales of dull grey hues, the scales on the process smaller than on the base, the process has also small thin forked scales below and is pale apically; metanotum chestnut brown; pleuræ bright brown with flat white scales. Abdomen covered with large flat brown scales above showing dull violet reflections; ventrally dull ochreous, apparently no border bristles and the large scales rather loosely applied to the surface; apex with a few bristles and some small fine black scales.

Legs rather long and thin, deep brown with dull violet and bronzy reflections in some lights, coxæ bright brown with some white scales; femora with dull white scales beneath.

Wings with the fork-cells small, the front sub-marginal longer and narrower than the second posterior, its base about level with the base of the second posterior cell, its stem very nearly as long as the cell, stem of the second posterior also nearly as long as the cell; posterior cross-vein a little more than its own length distant from the mid, the mid and supernumerary meeting at an angle; scales on the branches of the second long vein and on the apex of the first rather broad, flat and dense, on the remainder of the first rather spinose, on the other veins the lateral scales are linear but thicker than in *Culex*, median vein-scales single; upper costal border spinose.

Halteres with small yellow scales on the stem, dusky on the knob.

Length 4 mm.

Habitat: Peradeniya, Ceylon.

Time of capture: October, (1901).

Observations.—Described from a single perfect specimen, except for the ungues. It is a very obscure-looking insect except for the strange scutellar process.

EXPLANATION OF THE PLATES.

Plate A.

Fig. 1. MEGARHINUS MINIMUS, n. sp.
  a. wing of male.
  b. palp.
  c. anal segments.
Fig. 2. TRICHORHYNCHUS FUSCUS, n. sp.
  a. head.
  b. prothoracic lobe.
  c. scutellum.
  d. antenna.
  e. head (side view).
  f. frontal hairs.
  g. palp.
  h. clypeus.
Fig. 3. LOPHOCERAOMYIA UNIFORMIS, n. sp.
  Antenna of male.
  a. enlarged verticillate hairs.
  b. scapal knob.

Plate B.

Fig. 4. LOPHOCERAOMYIA UNIFORMIS.
  Palpi and proboscis of male.
Fig. 5. WYEOMYIA GREENII, n. sp.
  Antenna of male.
Fig. 6. RHACHIONOTOMYIA CEYLONENSIS, n. sp.
  a. scutellum.
  b. scutellar process.
  c. metanotum.
  d. palp.

DESCRIPTION OF A NEW SNAKE FROM BURMA.

Oligodon McDougalli.

By Capt. F. Wall, I.M.S., C.M.Z.S.

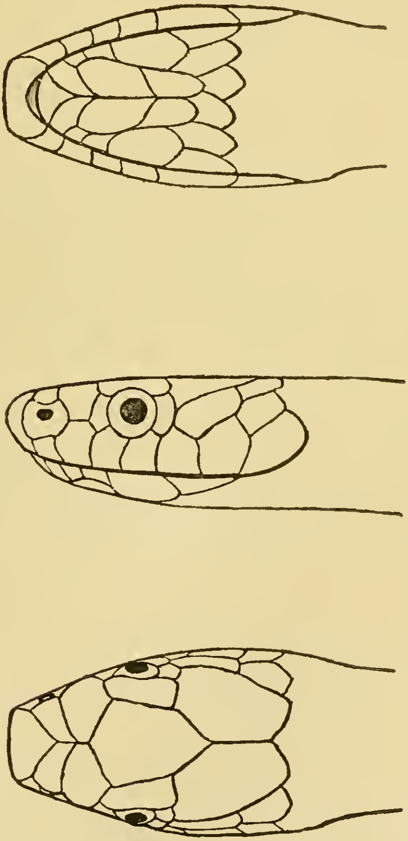
(*Read before the Bombay Natural History Society on 24th November* 1904.)

This specimen was obtained at Sandarang, Burma, by Mr. E. McDougall, after whom I have ventured to call it.

The description is as follows. Male ?

Length—13¾ inches ; tail 1⅞ inches.

Rostral in contact with 6 shields, of which the sutures with the internasals and nasals are subequal, and larger than the 1st labials. Portion visible above greater than distance to frontal. *Internasals* a pair ; the suture between them subequal to that between the præfrontal pair, about one-third the internaso-præfrontal suture. *Præfrontals* a pair ; the suture between them about one-third the præfronto-frontal suture. In contact with internasal, nasal, 2nd labial, præocular, supraocular, and frontal. *Frontal* in contact with 6 shields ; the supraocular suture rather larger than the rest, which are subequal ; length much greater than distance to end of snout, equal to parietals, about one-third greater than supraoculars ; breadth about three times each supraocular at a point opposite the centres of the eyes. *Nasals* undivided ; in contact with the 1st and 2nd labials ; nostril lying in the middle of the upper half of the shield. *Præoculars* one ; not extending on to crown.



Oligodon McDougalli. Sp. nov. (x 5.)

Eye moderate; pupil round. *Postoculars* one. *Temporals* one anterior in contact with two labials, the suture with the 6th about twice 5th. *Labials* 7; the 3rd and 4th touching the eye; last two largest, subequal. *Anterior sublinguals* larger than posterior; in contact with 4 infralabials. *Posterior sublinguals* in contact with one another, and with 4th infralabial. *Pentagonal* is the 4th and much the largest shield of the series; in contact with two scales behind; broader than posterior sublinguals. The first infralabial suture is about half that between the anterior sublinguals. *Scales* two heads lengths behind head 13; midbody 13; two heads lengths in front of vent 13. All rows subequal, even last not enlarged. Apical pits and keels absent everywhere. *Supracaudals* in even rows; midtail 6, end in twos (2 rows), fusion at the steps from the eights downwards effected by the blending of the two rows lying uppermost on each side. *Ventrals* 200; evenly rounded; the ultimate row of scales barely visible on either side. *Anal* divided. *Subcaudals* 39; in pairs. *Colour* dusky-black laterally, with a rufous brown, vertebral stripe from nape to tip of tail involving the vertebral and half the adjacent row; this stripe is edged by a series of linear black spots, most evident anteriorly. A linear black line on the confines of the 2nd and 3rd rows above the ventrals, interrupted anteriorly, and ending at vent. A supra-anal black bar and another subterminal, caudal, black bar. Head blackish. Rostral rufous-yellow, blotched black below. Labials mottled black and rufous-yellow. A rufous collar incomplete vertebrally. Chin, and throat rufous-yellow, mottled black in the sutures. Belly black, mottled fawn. Beneath tail black laterally, crimson centrally, the colour of a ripe yew-berry, and reminding one of the tail of *Simotes cruentatus.* The head is of the same calibre as the body, the neck very little evident, and the body wonderfully protracted and of even girth throughout.

PLAGUE, RATS AND FLEAS.

By Capt. W. G. Liston, I.M.S.

(With Plates A. & B.)

(*Read before the Bombay Natural History Society on 24th November* 1904.)

You may, perhaps, think that the choice of such a title for a paper to be read before a Natural History Society is somewhat out of place, and would have been more suitable for a medical gathering. Perhaps you are right, but I feel sure that the subject has a proper place under the circumstances. We are daily becoming more aware of the important part played in the spread of disease by the numerous animals and insects which surround us, and, as you will learn in the course of my remarks, plague is a disease which is pre-eminently dependent on such surroundings. A knowledge of Natural History is becoming a more important, I may say an all-important, branch of the medical profession. Quite apart, however, from such facts, plague is in the midst of us, carrying on its deadly ravages, and adding daily to its already uncountable death roll hundreds who, through ignorance of its mode of spread, fall victims to the scourge. Any ray of light shed into the darkness which surrounds the ætiology of this disease should not be confined to the medical world, but be cast upon the people that they may, perhaps, be enabled thereby to grope their way through the darkness to a place of safety.

You will appreciate the relation between Natural History and plague when I define the latter as a rat-disease. Not unfrequently, under favouring circumstances, it is communicable to man. The disease among men, therefore, might almost be said to be accidental, and certainly avoidable if there were a distance between rats and men. The communication of the disease to man is conditional on the propinquity or distance of rats and men from one another, and is dependent partly on the habits of the former and partly on the modes of living of the latter.

The ideas embodied in the above definition are not new. That plague is essentially a rat-disease was known to the ancients. We find the disease attributed to these animals by the priests and diviners of the Philistines, who instructed the people in these words—" Make images of your emerods and images of your mice that mar the land." They were to do so as a trespass offering to the God of Israel. (1) In the Bagavathi Purana the people are advised at the moment rats fall from the roof above, jump about, and die to leave their homes with their friends and relations, and to live in the plain. (^{2}) In Kumaun, where the disease has been known for long, the experience of the inhabitants has taught them that when rats die it is time to quit their homes for the jungle to save themselves from plague. It is stated in a report of the outbreak of 1834-35 that "the appearance of the disease in a village had been observed to be preceded by a mortality among the rats of the village." (^{3}) Coming to more recent times, Hankin, in reviewing the various circumstances that produced plague in Bombay, inferred that the incidence of Plague in localities and houses was in relation to their accessibilty to rats rather than to filth, over-crowding, &c. (^{4}) Simond also came to a similar conclusion from his experience of the disease. (^{5})

Dr. Ashburton Thompson, from his experience of the outbreak of plague in Sydney in 1900, formed the opinion that plague-rats constituted the sole source from which the infection was communicated to man. (^{6}) Dr. G. J. Blackmore, formerly Chief Plague Medical Officer, Port Elizabeth, very clearly and conclusively proved that the epidemic in that town was altogether spread by rats. He writes: "To sum up shortly, in places where infected rats were found, plague cases followed; and in places where there were no infected rats, only four cases of plague occurred, and in these cases the source of infection could not be traced at all. In no case was there direct evidence of man-to-man infection, and in most cases the possibility of it was definitely excluded." (^{7}) I need not quote further in this connection. *It is absolutely certain that rats are the most important factor in the spread of plague.* If plague is a disease of rats, then it is likely that the disease may have its own distinct laws of origination and continuance among these animals, man becoming affected chiefly when the disease is most prevalent among rats. It is precisely this study of plague among rats that has been neglected. Before any progress in this connection can be made, it is necessary to know something about the life and habits of rats.

What do we really know about rats? Very little. Now this is one reason why I am reading this paper before you to-day. You are all naturalists and, no doubt, keen observers. May I ask you to direct your attention to rats? Any notes upon the habits of these animals will be thankfully received by me.

Let me here discuss some of the important facts connected with the habits of rats, which have a bearing on the development and spread of plague, so far as they are known to me. In the first place, as you are aware, there are various genera and species of rats. I have tried to classify (more or less casually, I must admit) the Indian town or village rats; but I have completely failed. There appear at first sight to be many species. I visited the British Museum when at home, and saw Mr. Oldfield Thomas on this subject; and he assured me that any rat I sent from Bombay would be likely to be either a *Mus rattus* or *Mus decumanus.* I was discussing this matter the other day with a member of this Society, Mr. Aitken, and he suggested that it might be as easy to classify pie-dogs as the rats in Bombay. I am inclined to agree with him. There is apparently one fact evident that Mr. Oldfield Thomas is quite right in distinguishing only two *very distinct* species of domestic rat—*Mus decumanus* and *Mus rattus.*

Mus decumanus, the brown rat or Norway rat, is a large rat which in European countries has gradually displaced the smaller black rat, *Mus rattus.* This brown rat is much more a burrowing rodent than the black rat, and likes to live in drains and cellars; while the black rat prefers the roofs of houses and even trees to live in. The black rat, then, is, in a truer sense, a domestic rat; and it is the common domestic rat of India. This fact is an extremely important one from the point of view of plague. The immunity of European countries in the present day can, to a large extent, be attributed to the ousting of the black rat by the brown rat. The changes in the habits of man in European countries within the last two or three centuries, the development of drainage systems, the separation of workshops from dwelling-houses, the isolation of granaries and stables from human habitations, has led to the extermination of the black rat or at least to its separation from man. The opportunities for the infection of man with plague from rats have thereby been lessened, and, consequently, in Europe the development of plague in rats runs almost independently of the development of the disease in man. No more striking instance of this can be given than the experience of Glasgow. (8) Plague first broke out among the people of this city in the autumn of 1900; thirty-six attacks, with sixteen deaths, was the result of this epidemic. The origin of the disease could not be traced. All the cases were more or less associated with one another, and arose chiefly from three houses in which "wakes" were held over the bodies of individuals who had died of plague in the houses. At the time of this epidemic no rats were found affected with plague. There is good reason to believe, however, that although not found, yet the epizotic actually existed ; for, after an interval of a year, a second outbreak occurred, this time among individuals associated with a rag store. Rats affected with plague were found here, and continued to be found affected with the disease in various parts of the city at irregular intervals, for a period of two years. The only epidemic plague associated with this epizotic plague was that which occurred in some five individuals who worked in the rag store, and in other five individuals who worked or lived in the cellars of the Central Hotel. Plague-infected rats were found in the basement of certain tea rooms in Gordon Street. A rat warren was discovered, which, when the burrows were broken up, gave a bag of 67 rats which had either been killed or found dead. Of these 67 rats no less than 40 had plague. Rats affected with the disease were found in other places, and continued to be found, as I have remarked, for nearly two years ; but no plague occurred in men. It is evident we were here dealing with epizotic plague among rats of the species *Mus decumanus.* You note the diseased animals were found in cellars and burrows—places where rats of the species *Mus decumanus* are generally found—places where they were more or less isolated from man. Had the epizotic occurred among rats of the species *Mus rattus,* which inhabit houses, a very different tale would have been told. It is interesting to note the gradual disappearance of plague from Europe about the end of the 17th century—a time which was coincident with the invasion of the brown rat and the displacement of the black rat by that species. The species of rat affected by the disease has an important bearing on the spread of plague in man, not from any inherent difference in susceptibility to the disease in the particular species of rat, but because of the habits of the species. Another important difference will be noticed when I come to describe the fleas infesting these species of rats.

Now while there is the striking difference in the habits of the two species of rats, we have equally striking differences in the habits of the people inhabiting Europe and the East. I have referred to the fact, that, perhaps, the invasion of Europe by the brown rat may have been aided by the change in the habits of the people. As pucca buildings began to be erected, as drainage system developed, as stables

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proportionate to the severity of the destruction. Thus, if a trap is set, say, in one room which is frequented by rats, they will probably quit that room for a neighbouring room. But if a wholesale destruction is produced, as by placing poison in several places in a house, the rats will quit the house completely. Just so is it with plague. If conditions are such as are unfavourable to the rapid spread of the disease, the infected rats may linger on in a particular house, not being so thoroughly scared by the moderate mortality as to quit the house; infection may thus smoulder on in a particular house till the conditions become favourable to the extensive spread of the disease. I shall now consider what these favourable conditions are. They are associated with the breeding season of rats, and are due to the increase in the number of susceptible individuals and the multiplication of fleas, the carriers of infection.

The season at which the greatest number of young rats are present has a twofold influence on the spread of plague. In the first place, the arrival of young members among the community increase the number of individuals susceptible to the disease.

In the second place, the breeding season is, as a rule, the period of increase of the fleas which are peculiar to the rat. You must be familiar with the fact that kittens and puppies are especially covered with fleas. If you wish to get a particular flea which has a certain bird for its host, your best chance of obtaining that species of flea is to find the bird's nest. So precisely is it with the rats. Rat fleas are most numerous at the time when young rats are most numerous. I fancy I hear somebody say: "Oh! rats breed all the year round; they have no seasonal breeding time." This is true and it is not true. Rats do often breed all the year round; but I am equally certain that there is a season when more young rats are found than at any other season, and this season in Bombay is precisely the plague season. This is a very difficult matter to prove, and I should be very much obliged if any member could devise a practical method by which it could be proved. My inference has been made from observing the number of young rats brought to the Laboratory at certain seasons, and by noting the number of pregnant females which come for *post-mortem* examination. I am sorry, however, that I have no figures to offer wherewith to support my observation.

An epizootic of plague among a rat community is very often associated with a sudden and extensive spread of the disease; in proportion as there are more susceptible individuals present in that community, so the disease spreads more rapidly and extensively. A large number of the rats die from the disease; the rats become scared and migrate. The conditions in such a migrated rat community now are (1) there are a number of individuals which have recovered from the disease, and are therefore immune. (2) There is a greatly reduced number of individuals susceptible to the disease, because of the large number of deaths among the susceptible. (3) There are a few individuals which still harbour the disease and which have escaped with the others. (4) There is a greatly reduced number of fleas among the community, the infected fleas having for the most part been left behind. These are conditions where the chances of infection are greatly reduced,—where it is possible for one case to follow another only in slow succession,—where the panic of the rats, by the reduction of the mortality, has been quelled. Time passes; the disease smoulders; gradually the rats return to their old haunts, where above all other places they find food and shelter. The favourable breeding season comes round again, the number of susceptible individuals rapidly increases, and the number of fleas *pari passu* is multiplied. Conditions are re-established for a fresh and extensive outburst of the disease. Numbers of rats die from the disease. Again the rats migrate, and plague attacks man. It is thus that I would explain the seasonal endemicity of plague.

In the above remarks I have endeavoured to show the importance attaching to the particular species of rat inhabiting any place which may be subjected to plague infection. The black rat, *Mus rattvs,* the common domestic rat of India, of which there are probably very many varieties, has habits such as bring it into intimate contact with man. I have tried to show that the prevalence of this rat is in great part due to the habits of men in the places where it is found,—that it is possible by abolishing certain habits and customs to give the ascendency to quite a different species of rat, which is not so domestic as the Indian rat. In short, plague is likely to spread among men in proportion as *Mus rattus* is more common, and *Mus decumanus* less prevalent; in proportion, too, as men's habits are less or more civilised. I have drawn attention to the gregarious habits of rats, which would speedily end an epizootic of plague among them were it not for their habit of "migration," which causes infection of fresh communities in the same town or village by direct intercourse; and in distant towns, through human agency, were separated from dwelling-houses, as shops, warehouses, and granaries were no longer used as human habitations, as stone and wooden floors displaced mud and rush-covered ground, as beds became used in place of heaps of straw, so the black rat was driven from its haunts and the brown rat had it all his own way. Man and rats were separated from one another, and plague ceased to trouble ; for, as will be shown later, man plays an important part in spreading the disease among rats.

An observant correspondent, the Rev. J. H. Lord, who is much interested in the origin and spread of plague, very briefly puts it as follows:—

" What a timid and scared animal a rat is at home, living away in sewers or barns or hay stacks, as a rule only occasionally venturing among men. But here, in India, on the contrary, it is a confiding, almost domestic, animal, encouraged to impudence by the very aversion of Hindus to the destruction of animal life, while, on the other hand, modes of human life out here cause masses of people to live huddled together in what are almost barns and warehouses, in closest contact with rats ; and throughout the East it is more or less so, and I would even suggest that the plague has been able to catch on at various places more or less according as conditions are similar or dissimilar to what I have described, *e.g.*, at Alexandria, the Cape, Lisbon, Glasgow, &c.; also, when the plague in the Great Plague of London did catch on there, was it not perhaps because people were living a good deal in the insanitary way, then, as to overcrowding and contact with rats, &c., that they do in the East now ? "

So much for the difference between the two species of rats, the habits of each species, and the habits of man, which bring men and rats more or less in contact with one another.

Rats, like men, are gregarious creatures ; they have their communities in each town or village—communities which have little or no intercourse with one another. They have their maharwaras and buniapuras ; some live upon the refuse of the people, others install themselves in the granaries of the rich ; little communication, as I have said, takes places between these communities, but still less communication can there be between the rats of one town and those of another, except through human agency. Our high seaways, railways, and cart roads, all of them channels for the conveyance of merchandise, act also as a means of communication between the rats of one town with those of another; stray individuals are carried along with merchandise; stowaways, as they might be called, are taken from one town to another. This is only a chance means of communication between rats of one place and those of another; and the chances are, of course, greater where the means of conveyance is larger. Ships transport rats, therefore, in this way much more frequently than railway trains, and railway trains more frequently than carts.

Another habit of rats must here be considered, a habit too in which they resemble uneducated men. On the occurrence of any unusual mortality, from any cause, among a community of rats, they quit the place where the mortality has occurred;—they migrate as a community. In this way infection is often communicated from one community of rats in a village or town to another in the same village or town. Here a fresh focus of infection may in consequence be set up. Occasionally some individuals of such a migrating community may seek refuge in a ship or railway train or cart, and may carry this infection through human agency to another town. This is one important way in which plague may be spread from one place to another by human agency. Sea-port towns, as will be understood from what has been said above, are most frequently infected in this way. I would instance Sydney, Port Elizabeth, Durban, Lisbon, Glasgow, etc.

But there is another means of communicating the disease by means of human agency from rats of one town to those of another town, which will be discussed later when the part played by fleas in the spread of the disease is considered. I mention this fact here because it becomes possible only in connection with the migrating tendency of rats. I need hardly discuss at length this migrating instinct (shall I call it?) which impels rats to shun places which are associated with their death or destruction. Who has not set a trap for rats and found, that after two or three have been taken, the rats will not look near the trap again? Who has not noticed, that if a good dog or cat is introduced upon rat-infected premises, after a few of the animals have been destroyed the others disappear? Who has not noticed, that poison placed for rats will cause the disappearance of far larger numbers of them than are actually destroyed by the poison? This habit of migration, due to fear of destruction, is a very important habit of rats in the spread of plague. I should like, however, to emphasize the fact that the extent of the migration is and other adverse circumstances in uncongenial surroundings. While other non-spore-bearing bacteria readily perish when removed from their natural soil. The more resistant germs which do not produce spores have a protective wall which shields their internal contents.

The *Bacillus mallei* is a fairly resistant non-spore bearing germ. We should expect, therefore, glanders to be a disease which might be capable of transference from diseased animals, by various agents, to healthy animals; but the period of the vitality of the bacillus outside the body of an animal would be short, compared with the period of vitality of the spore-bearing anthrax bacillus. And this is precisely what we do find. Thus, we have such cases recorded as that of a woman who developed glanders three days after washing the clothes of a man who had died of the disease, or a case of a person who acquired the disease by being struck by the fist of a man who owned a glandered horse. Generally, however, the infection is more direct from the sick horse to man.

When we come to hydrophobia, we find that in order to produce the disease, infection must always be obtained direct from the diseased animal to the healthy,—generally by its bite. The germ is incapable of existing for any time outside the animal body.

Now, the plague germ does not bear spores; hence it cannot remain alive for a long period exposed to air and light and other adverse agencies, in the way the anthrax bacillus does. Nor yet has the plague germ any resistant cell-wall. Plague is certainly not conveyed to man by direct inoculation as hydrophobia is. How, then, can we explain the infection of man from the rat?

A little further thought on the methods of reproducing plants adopted by the mali will enable us perhaps to solve the problem. Has he any other method of making cuttings? Of course, there is the method of making a gooty. He selects a certain part of the plant, and ties around it some moss and earth which he keeps constantly moist. Many plants which could only be propagated by means of cuttings with difficulty can thus easily be reproduced. Have we anything analogous to the gooty in the case of plague? I believe the flea is the gooty. The plague germs which abundantly circulate in the blood in the final stage of the disease are taken up along with the blood by the flea. I show you a specimen under the microscope which is a section through the stomach of a flea. This flea was fed on a plague-sick rat, and allowed to digest its meal for 48 hours. The result is, that almost all the blood has been digested and absorbed, and the plague germs remain unaffected,—in fact, they appear to have multiplied, because they are far more numerous, than they could have been when ingested with the blood, and their appearance would indicate multiplication to one who is acquainted with bacilli which have been stained under such circumstances.

In the flea's stomach we find the plague germ in surroundings which will daily supply it with the very pabulum it desires—animal blood. The germ is not destroyed by the digestive juices of the flea. It is protected from light and dessication and the presence of contaminating bacteria, (weeds in other words,)—conditions which would have put an end to its existence if it had remained exposed on earth. We have all the conditions which are fulfilled by the gooty in the case of the plant. The gardener after a certain time cuts off the new plant below the gooty, and transfers it to its natural soil. So, too, the germ within the flea has now to be transferred to more suitable soil, the animal body; and this is accomplished by the bite of the flea itself. The flea, being animate, fulfils the double function of gooty and mali.

And now, to understand the last part of my subject, it is necessary to say a few words about fleas. It would be possible to write pages on the subject. My difficulty is to tell you enough in a short space, to fully explain the relation between fleas and the plague. I hope, therefore, you will bear with me if I detain you a few moments longer. There are four species of fleas met with in this country commonly associated with men and rats. Specimens of these are displayed under the microscopes. I can only now mention them by name, and detail a few of the habits of these species.

The most common flea and the one most universally distributed is the cat flea, *Pulex felis,* sometimes also called *Pulex serraticeps.* This flea is, for the most part, found on cats and dogs; but it is frequently taken on man too. I have also found it on rats, monkeys, sheep, deer, goats, guinea-pigs, the hedge-hog, and the horse. It is a rather small flea, but variable in size; and is of a dark colour. It is frequently found in light airy places, and it is not so nocturnal in its habits as the other fleas. Then, there is the human flea, *Pulex irritans.* It is a large fairly light-coloured flea, found almost exclusively in human habitations, and in only those of them which are dark and more or less dirty. I chiefly by ships or rail conveying merchandise. I have suggested that infection of rats in neighbouring towns and villages is affected by means of fleas carried by men. Finally, the breeding season of rats plays an important part in the spread of plague in man. Plague, which is essentially a rat disease, attacks men only when it is excessively prevalent among rats. The disease lingers on in these animals during the off-plague season, and bursts out afresh among the rats when the number of susceptible rats is increased by births; and when the fleas, the carriers and transmitters of the infection, are more plentiful.

If plague, then, is essentially a disease of rats, are there any other diseases which are peculiar to animals, and which are occasionally communicated to man? Does a study of these diseases furnish us with any evidence which may explain by analogy how plague is, or is not, or cannot be communicated to man? How is plague communicated from rats to men?

The following are epizootic diseases which are occasionally communicated to man, and I would class plague along with them; namely, Anthrax, Glanders and Hydrophobia.

Anthrax is a disease of cattle which is caused by a spore-bearing bacillus. It gives rise to at least two forms of disease in man and in this respect resembles plague; namely, a disease called Malignant Pustule which is produced by the inoculation of the bacillus under the skin; and "Wool Sorter's" disease, which is produced by the inhalation of the bacillus, into the lung, as occurs in primary plague pneumonia.

Glanders is a disease of the horse which is due to a bacillus, the *Bacillus mallei.* The disease is generally found in man among farriers, grooms, nakers and others who are associated with horses. In man the disease is very fatal.

You are all familiar with hydrophobia, which is a disease of dogs, and which is occasionally communicated to man, and is in him a fatal disease.

Let me here digress by giving a popular exposition of the bacteriology of these diseases. Germs or bacteria are divided into two classes, the pathogenic, or disease-producing, germs; and the non-pathogenic germs, which are abundantly found, in nature, in the earth and air all around. Now bacteria are fungi, which, as you are aware, are a class of plants or vegetable organisms. In plant life, therefore, we find many laws which are equally applicable to bacteria. Now, just as you know that some plants grow in earth and others in water, so we find some bacteria capable of growing in earth, and others capable of growing in the animal body; these latter are the pathogenic or disease-producing germs. Just as you would not expect a "water lilly" to grow on dry earth, so you cannot expect the pathogenic bacteria to find a suitable soil in the earth; or earth organisms a suitable soil in the animal body. I know of no pathogenic organisms which have been proved to be capable of development in earth; and the plague bacillus is no exception to this rule. You are familiar with the fact that plants can be reproduced either by seeds or by cuttings. Bacteria multiply in the same way. Some bacteria produce spores, which are practically seeds; and others reproduce themselves by a simple process of cleavage,—a portion is given off from the parent bacterium, which is capable of reproducing itself, as a cutting does. Now a seed can be kept for a long time in surroundings which are unsuitable for its development, but when introduced into suitable soil it buds forth and blossoms. It is precisely so with spore-bearing bacilli, they are capable of withstanding long periods of dessication, etc., and ultimately when introduced into suitable surroundings they develop and multiply. Anthrax is a pathogenic, spore-bearing, bacillus. By that I mean that its soil is the animal body, and it is able on account of its spores or seeds to lie dormant in surroundings which are unsuitable for its development—such surroundings as are found in earth, on hides, and wool. Hence we find that anthrax in the cattle in India can give rise, months afterwards, to anthrax in man in England. The disease germs in the form of spores are transferred on the hides and in the wool of the animals which have died of anthrax in India to England, where among the workers in hides and wool the anthrax spores, which have lain dormant during the voyage, may find suitable soil when introduced into a cut or abrasion on the hand or other part of a hide-worker or wool-sorter, producing anthrax in the unfortunate man.

Again, we know that cuttings from some plants, for example the rose, can be left exposed to air and light for some time, while cuttings from other plants must be directly inserted into suitable soil after removal from the parent plant. The resistance depends on the texture of the plant, whether it has a hard protective covering, or only a thin cuticle. Precisely so is it with bacteria; some bacteria, which reproduce themselves only by fission (cuttings), can resist light and dessication come now to rat fleas. The common flea found on *Mus rattus* is *Pulex cheopis.* It is therefore the common rat flea of India. It is a small light-coloured flea, which is particularily sensitive to light, loving the dark ; and it is, therefore, more or less nocturnal in habit. It is seldom found apart from the rat in this country, and lives chiefly in the haunts of the black rat, among grain bags and in the roofs of houses, etc. At first sight it is very like the human flea. The flea commonly found on *Mus decumanus* is called *Ceratophyllus fasciatus.* In so far as *Mus decumanus* is rare in this country, this flea is also seldom found in India ; but it is the common flea found on the rat in Europe.

These fleas can be distinguished from one another in both sexes by noting if there is a comb of bristles behind the head. *Pulex felis* and *Ceratophyllus fasciatus* have both got combs in this situation. *Pulex felis* has in addition a set of teeth-like bristles surrounding its mouth ; *Ceratophyllus fasciatus* has not got these bristles. *Pulex irritans* and *Pulex cheopis* have no comb of bristles behind their head. They are readily distinguished by the length of the anti-pygideal bristles, which are short in the human flea and long in the rat flea. The claws of the human flea, too, are very large and scythe-like; while the rat flea has more elegant scycle-shaped prehensile organs. The males of all four species are at once distinguished by the characteristic shape of the claspers.

Now you will notice that most of these fleas have a particular host. The cat flea, however, is more or less an exception to this rule, for it is often found on other hosts than cat or dog. If this is the case, how is it possible to explain the infection of man from the rat, when, under ordinary circumstances, the human flea is only found on man, and the rat flea on the rat ? This fact, more than any other, I think, has prevented men from accepting the flea theory of the spread of plague, for not a few instances have now been reported in which plague has been directly communicated from the diseased rat to the healthy rat by means of fleas. But, it is objected, how can men become infected if the rat flea is never found on man ? I have had the good fortune to discover an explanation of how the rat flea can communicate the disease to man, although normally the rat flea, *Pulex cheopis,* is scarcely ever found on man.

In March 1903 some guinea-pigs, which had died in the Victoria Gardens, were sent to me for examination. I found that they had died of plague. I immediately visited the gardens to see if I could find any fleas on the guinea-pigs ; to my surprise they were covered with fleas. An examination of these fleas showed that they were rat fleas, *Pulex cheopis.* The following history of the disease was given to me by the Superintendent. A few days before the guinea-pigs became ill, dead rats had been found near their cage. The guinea-pigs had then sickened, and two keepers who had charge of them took plague and were sent to hospital. One or two of the guinea-pigs had died before the dead animals were sent to me for examination. When I saw the guinea-pigs in the gardens many were sick, but some appeared healthy. It was interesting to note that the sickly were those most infested with fleas. From one sick guinea-pig no less than eighteen fleas were removed. This is an important fact to note, in that, thereby the number of infected fleas will be greatly increased. An examination of a large number of guinea-pigs kept in our Laboratory stock showed that these animals seldom harbour fleas, the only flea found on them under normal conditions is a very occasional *Pulex felis.* This unusual infection of the guinea-pig by *Pulex cheopis* remained for some time a mystery; but an explanation was gradually forthcoming. Here, no doubt, infected rat fleas had communicated the disease to the guinea-pigs ; but why were rat fleas found on guinea-pigs ? The problem was solved in the following way. A friend who lived in two semi-detached bungalows kept a cat. One of the bungalows was used as a nursery for the children, and the nursery was the favourite haunt of the cat. When the hot weather came on, the children were sent to the hills, the nursery was shut up, and the cat had to find other quarters. About a month later my friend had to re-open and enter the nursery to get some things for the children. No sooner had he entered than he was bitten by a flea, and then by another and another, and to his surprise he found many fleas on his legs. He caught these fleas and brought them to me, and when I examined them I found them to be cat fleas. Now as long as the cat lived in the nursery, fleas never troubled the inmates, but when the cat had been excluded the cat fleas swarmed on to man. Starvation apparently had driven them to man.

Another opportunity presented itself in the case of a stable. This stable had been shut up for some weeks, but had formerly been inhabited by a dog as well as a horse. When the door of the stable was opened, fleas literally swarmed out on to the man who opened it, almost as a hive of bees might do when disturbed. One had only to approach the stable door, and immediately one's trousers were covered with fleas. These fleas were *Pulex felis*, which we saw was the common dog flea. Here, again, driven by hunger, in the absence of the dog, man was attacked. Herein lies, too, the explanation of the swarms of fleas one reads and hears of in dâk bungalows in India. Somebody has been there before with dogs. The dogs left with their master, but left their fleas behind. The bungalow was shut up for a time, another sahib entered, this time without a dog. He is immediately attacked by the fleas.

Finally the proof was completed by the following experience for which I am indebted to the Revd. J. H. Lord. On April 20th last year he sent me some fleas which had been caught on man in a house which was infected with plague under the following circumstances. About the 6th or 7th of April, rats began to die in large numbers in the chawl in which this house was situated. Suddenly the deaths amongst rats ceased and on April 11th the people became troubled with fleas. The fleas were so numerous that they had to quit their rooms and sleep out in the verandah. While living in the verandah on April 17th one of the inhabitants of the particular room in which the fleas were taken, became infected with plague. Another case occurred on the same day in a room adjoining. This room was separated from the aforementioned room only by a partition 6½ feet high. On the same day the information about this chawl came to Mr. Lord. He succeeded in getting the people who inhabited the room where the above case occurred to collect some of the fleas which they said troubled them, and he sent the collection to me on April 20th. An examination of this collection was most instructive. Now I must tell you that on previous occasions, of 246 fleas which were caught on man under normal conditions I had only found one rat flea, *Pulex cheopis*. But of the collection of 30 fleas caught on man under the circumstances above recorded no less than 14 of these were rat fleas. Nothing could be more striking.

Now what is the explanation of such unusual invasion of the guinea-pig and man by rat fleas? You note, that in both cases, a few days before, rats had been noticed dead in considerable numbers; then no more rats were found dead, and plague broke out in the guinea-pigs and men. Taking this in conjunction with the facts above recorded regarding the starved fleas, I think the explanation is that, either the rats had been almost completely exterminated by the plague, or what is more probable on the occurrence of a large number of deaths, they had migrated. In consequence the fleas which they left behind them in their nests and haunts had to seek food somewhere else, and under these circumstances had attacked the guinea-pigs and men. Herein I think we have the explanation of the common phenomenon (1) plague among rats with many deaths, (2) a lull, (3) then plague among men. Since these cases occurred I have been on the look out for fresh opportunities, but you will readily understand that information of this sort is difficult to be obtained by one individual. Will you help me to examine such cases? When you hear of any unusual number of deaths among rats from plague, please let me know at once; and if we are unable to persuade the people to catch the fleas on their persons, I propose to use guinea-pigs to trap the fleas by placing these animals in the probably infected rooms and then we shall be able to see whether rat fleas are straying about, for they will take to the guinea-pigs and can easily be captured on these animals.

If rats can communicate the disease to man it is equally certain that man can carry the disease to rats. I have already explained how the disease can be communicated to distant towns and villages from infected rats in one place, to those in the other place by human agency. But there are other well-recognised cases where infection has been carried from one village to a neighbouring village by man, where the possibility of the direct transference of infected rats from the one place to the other is absolutely excluded. The record of such cases is almost legion. I take 2 cases of 12 recorded in the excellent report on Plague and Inoculation Operations in the Amritsar District in 1903 by Captain S. Browning Smith, I.M.S.

Kadgil (the name of the village). "Here the disease was brought from Tharu, by Buta, a weaver, in November 1902. He died after three days' illness, and three other deaths occurred in this house within five days; rats died in this house, and were allowed to remain, and the house was locked up; plague did not spread at the time, and no other case occurred for two months, when dead rats were noticed in some sweepers' houses that adjoined Buta's house; seven days after dead rats were seen, the disease appeared among the sweepers."

"*Phailloke.* The disease was brought from Chala, Lahore District, by Chet Singh, who returned to Phailloke on the 25th March 1903. Rats began to die on the 29th March 1903. Chet Singh fell ill on the 2nd April, and died on the 8th April. Three other cases occurred in the same house."

Captain Browning Smith remarks: "The above is a case where it seems that infection was brought in the clothes of the man; rats were infected from this, and the man himself was infected from the rats." The cases speak for themselves. The explanation I offer is that a man living in an infected village takes fright when he finds cases of plague occurring among others in his own house. The infection of this household was clearly brought about in the way I have described above; rats died, the remaining ones migrated, the hungry infected fleas they left behind attacked man; man became infected—some of these fleas having got among the clothes of the fugitive man, he has carried them to the village to which he has fled. The fleas may have in the meantime attacked him and if so he died of the disease shortly after his arrival; but possibly the fleas may have failed to get through his clothes, the man then remains unaffected. When transferred to the new village in this manner, the fleas find themselves in fresh rat-infested premises, and are not long in scenting out their natural host the rat. They infect the rats, the disease spreads among the rats rapidly, they die; the rest take fright and migrate; man becomes infected.

But why press this flea theory, you will say, when we know perfectly well that the excreta from infected animals is capable of infecting fresh animals. This is a gratuitous assumption. Have you tried it? I have. Healthy rats can live in the same cage with infected rats without acquiring the disease, if only fleas are excluded. I told you of such experiments when I read a paper before you in March last year. Since then other persons have independently confirmed my observations, particularly Dr. Klein.[9] I have here been able to prove that although susceptible animals do take plague through the alimentary canal if fed on large quantities of grossly contaminated food, yet they can eat food which has been contaminated by a relatively small quantity of plague without harm. Moreover, what is more important, they are not infected with the insufficiently large quantity of plague which is contained in the various excreta of plague-infected man or animals. I have fed rats on such excreta, and kept them in contact in a small cage with clothing which had been soiled by dying plague patients, and they have not suffered from the disease.

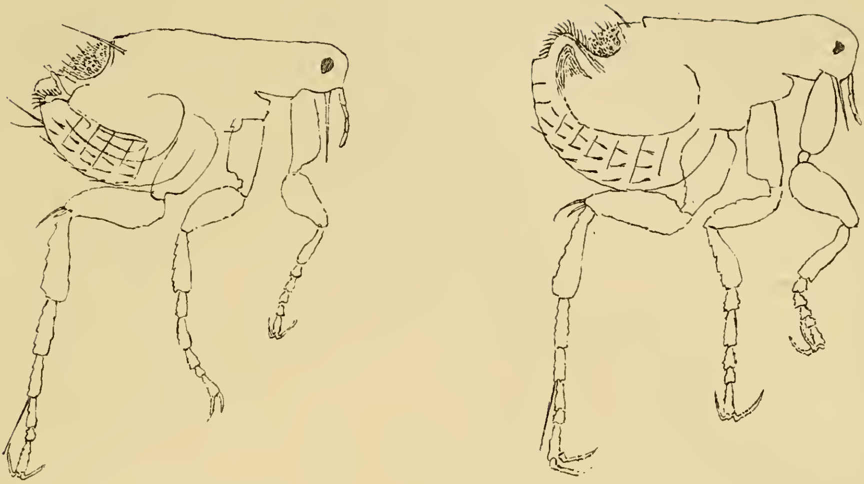
But when even one or two germs are introduced by a needle under the skin, death almost always results. Thus, a guinea-pig has died of plague after receiving one quarter of a c.c. (about 4 drops) of a ten millionfold dilution of a 48-hours' broth culture of plague. In this quantity I was able to show there were not more than one or two germs. If only one or two germs are necessary to infect an animal by injection under the skin, while millions are necessary by any other channel, which is more likely to be the common method of infection?

Simond (10) long ago showed that phlyctenules (blisters occasionally found in cases of plague, and which reveal the point of inoculation of the bacillus) often occur in parts little liable to abrasion (such abrasions might permit the plague germs to enter the blood), but which are frequently attacked by fleas. If cuts and abrasions were the chief source of infection, phlyctenules would be commonly found on the soles of the feet of those who go about bare-footed, but this is not the case. Phlyctenules in this situation are extremely rare, while they are most common just in the situations which are most subject to be attacked by fleas. Again, the boot-wearing people of Australia suffered as frequently from buboes in the groin as the bare-footed natives of Bombay;—73 per cent. in the one case, 67 in the other (11). If the bacillus lived in the soil, it would have been reasonable to expect a larger number of groin buboes in the bare-footed natives than in the booted Australians. Moreover, the common sources of infection with plague are dark, dirty, overcrowded, vermin-infested houses; also clothing and grain. It is just on these surroundings that fleas may be found. We know, too, that houses and clothing can be indirectly infective through the medium of a healthy uninfected individual. The healthy individual carries with him something, presumably infected fleas, to another individual who sickens with the disease.

The seasonal prevalence of plague can to my mind be most easily accounted for by the greater prevalence at some given time of some intermediary host of the plague bacillus after the same manner as the prevalence of malaria is associated with the prevalence, at certain definite seasons, of certain species of mosquitoes of the genus *Anopheles*. On several occasions fleas have been noted to be specially abundant prior to or during the course of an epidemic of plague. I will only mention 2 instances. Thus, for example, Dr. Tidswell's attention was directed early in the epidemic of plague in Sydney in 1900 to the unusual prevalence of fleas in the infected quarters. He writes : "At the time the rats were dying in large number upon the wharf, to which attention was called above ; the fleas there were so numerous that the labourers tied string round the bottom of their trousers to protect themselves against the onslaughts of the vermin" (12). Again, in connection with the rat epidemic of plague at Cardiff in February 1901, I quote from the Local Government Board Report for 1902 : "Fleas in considerable numbers were observed on the white flour sacks in the warehouse mentioned" (13). I have on more than one occasion been told that before an outbreak of plague occurred, fleas were noticed to be very prevalent ; the only wonder is, as Tidswell (14) has expressed it, that such a fact should have been noticed at all, for the social status and domestic habits of most people among whom plague occurs is not such as to invest a little incident of this sort with remarkable novelty. Finally, there are many facts to my mind which cannot be explained on any other hypothesis ; I will only mention a few of them here.

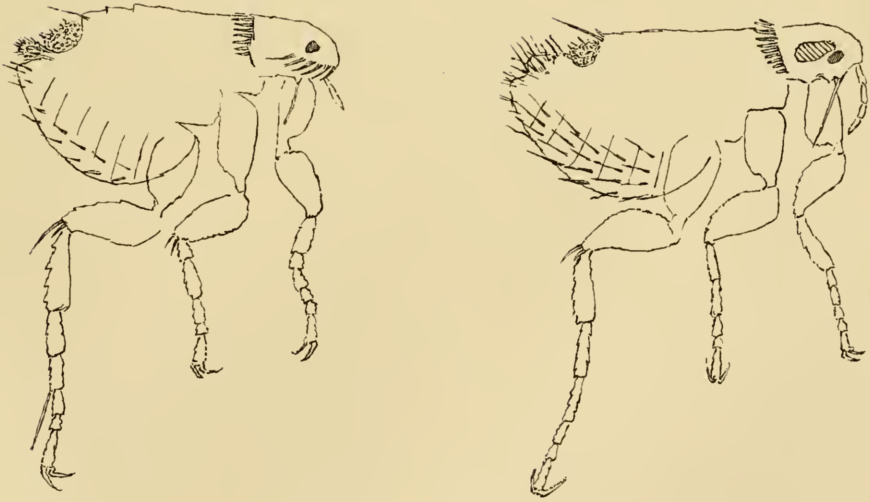
Mr. Nigel Paton, who is in charge of a large oil store in Bombay, wrote to me after reading my paper published in the Medical and Physicial Society's Transactions last year, (15) that he had been at a loss to explain why every year during the plague epidemic he lost several hands employed by him in the office connected with the store, while, since the plague has broken out in Bombay, he did not remember a single death from plague having occurred among the hands he employed in the store itself, although the hands employed in both departments lived in much the same manner, and in the same infected surroundings. Unfortunately he could not support the statement by statistics, but he said it was a well-known fact in the office, and had annually been commented on. His explanation of the fact now is this, that the men in the oil store itself were constantly handling oil, to such an extent indeed, that their bodies were covered with it ; and he presumed that probably the smell of the oil, or some other cause connected with the oil, prevented the infected fleas biting the oil workers, and so they escaped the disease. Now Mr. Paton's experience is by no means unique. In 1797 it was observed by Mr. Baldwin, the British Consul in Egypt, that among the millions of inhabitants who died of plague in that country in the space of four years, not a single oilman or dealer in oil had suffered (16). Sir J. McGregor remembered that all the men employed in applying oil to the camels' feet during the Egyptian campaign escaped the plague (17). Mr. Jackson states that the coolies employed in the oil stores of Tunis smear themselves with oil, and are rarely affected with plague when it rages in that city (18). It is also stated by Luigi of Pavia that during the 27 years he was attendant at the pest house in Smyrna, he found friction with oil more efficacious than any other medicine both as a prophylactic and as a means of cure (19). In the plague epidemic in India in 1815 and 1819 Mr. White, talking of the common practice in many parts of India—friction to the body with oil, says "This (practice) has, upon very good authority and extensive experience, been supposed a complete preventive, as well as a powerful agent in the cure of plague" (20). Mr. McAdam says: "Another remark which the natives make, and which I think is likely to be just, as they are not apt to take notice of anything that is not extremely obvious, is, that those engaged in the expression of oil are not liable to infection" (21). Can the relative immunity of Calcutta and Madras compared with Bombay and the Punjab be due to the habit of daily anointing the body with oil in the former two presidencies? I was very much struck by this habit in Sambalpur, where recently I was Civil Surgeon; the people in this district follow partly the habits of the people of Calcutta and partly those of Madras. I was informed that the Jubbulpore Municipality placed it on record during a very severe epidemic two years ago that tobacconists who lived in their shops were peculiarly exempt from the disease.

It is notorious how frequently visits at night to plague-infected houses have been followed by fatal results while the same houses could be entered with impunity by day. In this connection the following quotation from the report of Dr. Watson on the Mahamari (plague) of Kumaon is of interest (22): "The experience of Dr. Renny, Dr. Pearson, Dr. Francis and others has proved that a medical officer can without danger feel the pulse of a plague patient and give him medicine, and also that medical officers can without danger examine by dissection the body of a man who has died of plague. That is to say, he can do these things by day, with the sun shining and the air tolerably warm. I do not believe he could do any of them with impunity after nightfall." Take these facts in conjunction with the observations I have made that *Pulex cheopis* shuns the light, and the facts which I communicated to you in the paper which I read before you last year. I



P. Cheopis

P. Irritans



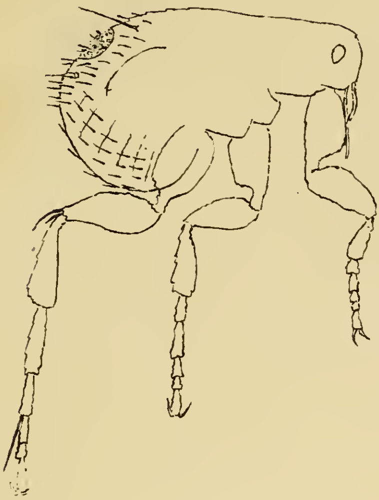
P. Felis

C. Fasciatus

MALE FLEAS.

Cortez & Co. Lith. Bombay.

D. A. Turkhud M. B. Del.



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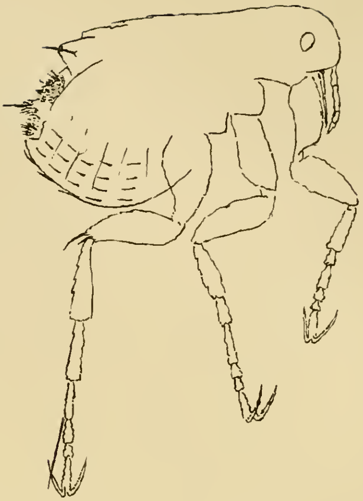

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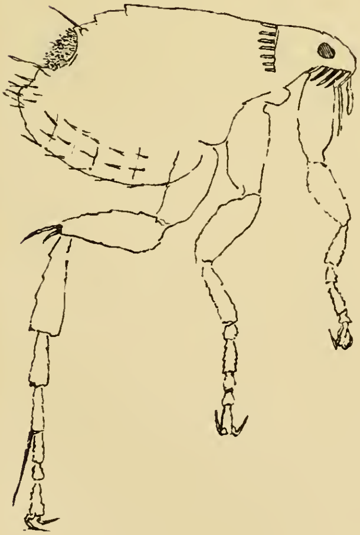
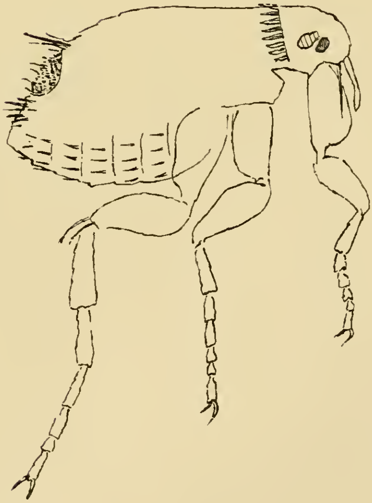


P. Felis



C. Fasciatus

FEMALE FLEAS.

Cortez & Co. Lith. Bombay.

D. A. Turkhud M. B. Del.

then told you that I had noticed that on certain days I was able to get many fleas from the rats sent to the Laboratory, while on other days none were obtained. As many as 53 rats on one day were examined and not a single flea was obtained, while on another day 13 rats yielded 22 fleas. In seeking for an explanation for this I noticed that when the rats were brought to the Laboratory in a dark iron cage, fleas were plentifully found on the rats, while when they were brought in an open wire cage no fleas were found on them. I also noticed that if the rats were kept in open cages in a light place, all the fleas that were placed on them disappeared.

It would be possible thus to greatly enlarge upon this subject; but already I have occupied you far beyond the usual time devoted to a paper. I had sketched out in my plan of this paper a heading which was to deal with the lessons to be learned from the facts placed before you. I cannot, however, do so to-day; perhaps some other opportunity may present itself. I will only say that it is obvious that any changes which will free Bombay or India of plague can only be introduced gradually, as the people become more educated and civilised, and learn that rats are the most important factor in the spread of the disease. If we cannot speedily place a distance between ourselves and rats, we can at least protect ourselves from the danger of their propinquity by acquiring immunity to plague by inoculation. This is to my mind the only measure that offers any hope in combating the disease in the near future.

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(4) Hankin, Annales d l'Institut Pasteur, 1898.

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(9) Local Government Board Reports, 1902-1903.

(10) Annales d l'Institut Pasteur, October 1898.

(11) J. A. Thompson, Journal of Hygiene, April 1901, p. 166.

(12) F. Tidswell, Journal of Sanitary Institute, Vol. XXI, Pt. IV, p. 569.

(13) Local Government Board Report on Plague, by Bruce Low, 1902, p. 31.

(14) F. Tidswell, Journal of Sanitary Institute, Vol. XXI, Pt. IV, p. 569.

(15) Liston, Transactions of Bombay Medical & Physical Society, February 1903.

(16) Duncan's Annals, 1797.

(17) Medical Sketches, 1804.

(18) On the Commerce of the Mediterranean, p. 46.

(19) Quoted in Cyclopædia of Practical Medicine, Article "Plague."

(20) Transactions of Bombay Medical & Physical Society, Vol. I.

(21) Transactions of Bombay Medical & Physical Society, Vol. I.

(22) Appendix XXV, Indian Plague Commission's Report, Vol. II, p. 364.

A CATALOGUE OF THE *HETEROCERA* OF SIKHIM AND BHUTAN.

By G. C. Dudgeon, F.E.S.,

With Notes by H. J. Elwes, F.R.S., &c.

and

Additions by Sir George F. Hampson, Bart., B.A., F.E.S., &c.

Part XVII.

(*Continued from page* 613 *of Vol. XV.*)

Family NOCTUIDÆ—*contd.*

Sub-family *CUCULLIANÆ.*

Genus Cucullia, Schrank.

1807. *C. albescens,* Moore.

Sikhim. I have this only from the Punjab, but it is probable that it occurs all along the Himalayas at suitable elevations. (A single specimen from Möller identified by Sir Geo. Hampson.—*H.J.E.*)

1808. *C. nigrifascia,* Hmpsn.

Sikhim. Mr. Elwes took a single specimen of this at light at Darjeeling in August.

1810. *C. brevipennis,* Hmpsn.

Sikhim. I have not seen this. (I do not know the authority for the Sikhim specimen recorded by Sir Geo. Hampson, my only example is from the Nagas.—*H.J.E.*) (Darjeeling, Moore Coll. in B. M.—*G. F. H.*)

1812. *C. pullata,* Moore.

Sikhim. I have seen only this from Kulu in the Punjab. (I took one of this fine large Cucullia on Tonglo in July and suppose it to be a high-level species.—*H.J.E.*)

1806*a*. *C. poliorhiza,* Hmpsn.

Yatung. I have a single specimen of this from Mr. Lister obtained at the frontier station. Although it is in bad condition it is easily recognised by comparison with Sir Geo. Hampson's figure in the Bo. Nat. Soc., Vol. XIII.

Genus Polia, Ochs.

(Out of all the species placed in this genus in Moths of India and recorded from Sikhim it appears from Sir Geo. Hampson's new classification the following Nos. belong to the genus *Crymodes* in the sub-family *ACRONYCTINÆ*:—1786, 1787, 1788, 1790, 1791, 1792, 1796; while 1794 is said to be a Cucullian of uncertain genus and 1793 and 1797 are not in the B.M. collection and are therefore at present uncertain. I am leaving only the last three in this genus.)

1794. *P. griseirufa*, Hmpsn.

Sikhim, 10,000 ft. No specimens. (I have four specimens, one of which I took on Tonglo, the others at or near Darjeeling.—*H.J.E.*)

1793. *P. microsticta*, Hmpsn.

Sikhim. I do not know this. (The unique type of this came from Möller. I do not know where it was taken, but I suspect it is not rightly placed here.—*H.J.E.*)

1797. *P. sinuata*, Moore.

Sikhim, 10,000 feet. (Another of the rarities which I took on that wonderfully successful expedition along the Nepal frontier during the height of the rainy season in 1886.—*H.J.E.*)

Genus SYDIVA, Moore.

1765. *S. nigrosgrisea*, Moore.

Sikhim. This species which I have not seen would appear to come into this sub-family and should therefore be separated from *Ancara* in which it is placed in Moths of India and which latter genus belongs to the next sub-family. (I took one on Tonglo in July and have others from Atkinson and Möller, the latter dated 30th May 1888.—*H.J.E.*)

Genus ELWESIA, Hmpsn.

1597. *E. diplostigma*, Hmpsn.

Sikhim, 10,000 feet. I believe this species has been obtained at high elevation, but I have not seen it. (The type female I took on Tonglo. I have one male from Knyvett's collection.—*H.J.E.*)

Genus BOMBYCIA, Steph.

1710. *B. rubida*, Hmpsn.

Sikhim, 10,000 feet. I do not know this. (The unique type was taken by me on Tonglo at light in July and is in rather worn condition. —*H.J.E.*)

1799. *B. grisea*, Moore.

Sir Geo. Hampson removes this from *Polia* to this genus.

Sikhim, 15,000 feet. (Of this I have never seen a specimen except in Atkinson's collection.—*H.J.E.*)

Genus Epunda, Guen.

1740. *E. lagenifera*, Moore.

Sikhim. This insect was placed with the next in the genus *Euplexia* in Moths of India, but belongs to this sub-family. (I have five from Sikhim and one from Manipur which I believe to be this species.—*H.J.E.*)

1751. *E. pardaria*, Moore.

Sikhim. Placed in *Euplexia* in Moths of India, but should be removed to this sub-family.

Sub-family *ACRONYCTINÆ.*

Genus Crymodes, Guen.

1786. *C. herchatra*, Swinh.

Sikhim, 7,000 feet; Bhutan, 6,400 feet. I have only taken this in at light. (This pretty little Noctuid was common on the Nepal frontier from 10,000 to 12,000 feet in July.—*H.J.E.*)

1787. *C. sikkimensis*, Moore.

Sikhim, 10,000 feet. (I took two on Tonglo and have another from the Tibet frontier or Chumbi valley.—*H.J.E.*)

1788. *C. canosparsa*, Hmpsn.

Sikhim, 12,000 feet. (This is a common species on the Nepal frontier from Tonglo up to Jongri at 13,000 feet or upwards.—*H.J.E.*)

1790. *C. endroma*, Swinh.

Sikhim and Bhutan. Occurs but rarely at high elevations in Bhutan in September. (Also common on the Nepal frontier, but I did not take it as high up as the last.—*H.J.E.*)

1791. *C. dentata*, Hmpsn.

Sikhim, 10,000 feet; Bhutan, 7,000 feet. I have five specimens brought in by my collectors taken in July. (Rather like, but I think quite distinct from the last species and found along the Nepal frontier from Tonglo to Sundukpho.—*H.J.E.*)

1793. *C. castanea*, Moore.

Sikhim, 7,000 feet. Taken by Col. Pilcher probably at Darjeeling from whom I obtained a specimen. (I have only one specimen of this fine and distinct species from the interior of Sikhim. I do not think it occurs at Darjeeling, but if so must be rare.—*H.J.E.*)

1796. *C. junctura*, Hmpsn.

Sikhim, 7,000 feet. (Of this distinct species I have only two from Möller's collection. The elevation given is doubtful.—*H.J.E.*)

Genus SESAMIA, Guen.

1798*a*. *S. fumea,* Hmpsn.

Sikhim, 1,800 feet. The type of this was taken by me at Pankabaree. I have not seen another. This species, which was originally placed in the genus *Polia,* Sir Geo. Hampson now refers to *Sesamia,* Guen.

Genus SPHETTA, Wlk.

1585. *S. apicalis,* Wlk.

Sikhim, 3,000 feet. I have taken this at Vah on the Tukvar spur and bred others from larvæ taken at the same elevation. The dates on my specimens are May, June and August. The expanse of my specimens is greater than that recorded in Moths of India, being 47 millim. ♂ and 53-59 millim. ♀.

Genus AMPHIPYRA, Ochs.

1655. *A. monolitha,* Guen.

Sikhim. I have this from the Kangra Valley, but never saw a specimen from Sikhim or Bhutan. (Not in B. M. from Sikhim—*G.F.H.*) (I doubt its occurrence in Sikhim —*H. J. E.*)

1658. *A. cupreipennis,* Moore.

Sikhim. This also I have not seen (Sikhim in B. M.—*G.F.H.*)

Genus EUPLEXIA, Steph.

1711. *E. nubilata,* Hmpsn.

Sikhim. Taken by Möller at 6,000 feet. I have no specimens. (Two in my collection without exact locality.—*H.J.E.*)

1712. *E. indistans,* Guen.

Sikhim and Bhutan, 1,800-4,000 feet. I cannot separate this from the next when trying to identify females. The only feature which is different in the male is the ferruginous suffusion present in *indistans,* but I have a specimen of *niveiplaga* with the white patch on the reniform which is distinctly reddish on the underside. My specimens were taken in April, May, July and September. (Either species may have the white patch on reniform.—*G.F.H.*)

1713. *E. niveiplaga,* Wlk.

Sikhim and Bhutan, up to 5,000 feet. All the forms of this are apparently equally common. I have taken it in May, June, August, September, October and November.

1715. *E. fulvistigma,* Moore.

Sikhim and Bhutan, 1,800-6,000 feet. I also think that this species and the next will eventually be found to be one. The darker suffusion of the inner half of the forewing in *sodalis* is the only distinguishing mark I can see in some of the redder forms of the latter species. My specimens are all marked May. (I have two specimens from Sikhim and one from the Khasias which agree with the type of *Hadena constellata*, Moore placed by Hampson as a synonym of this.—*H. J. E.*)

1717. *E. sodalis*, Butl.

Sikhim and Bhutan, 3,000 feet up. A very common insect occurring in May and June.

1717a. *E. oxydata*, Hmpsn.

Sikhim, 7,000 feet. I do not know this. (Sikhim, *Pilcher* in B. M. —*G. F. H.*)

1795a. *E. pyroxantha*, Hmpsn.

Yatung. This will probably be found on this side of the passes also. Sir Geo. Hampson thinks that the position of the insect is better in this genus. It was originally described as a *Polia*.

1721. *E. conducta*, Wlk.

Sikhim and Bhutan, 1,800-2,500 feet. This is a common species occurring in May, June, August and September. The form *galaxia*, Butl., is rarer and I have only taken it at 4,500 feet in Sikhim and in the Kangra Valley. Apart from the difference in the ground colour of this latter form from typical *conducta* the reniform which is formed of distinct white spots in a cluster is much further from the postmedial line. It seems to me to be distinct, but my series is not long enough to determine.

1722. *E. albimaculata*, Moore.

Sikhim and Bhutan, 2,000-5,000 feet. Not uncommon in May, June, August and September, attracted to light. (I took it at Darjeeling at light.—*H.J.E.*)

1723. *E. leucospila*, Wlk.

Sikhim and Bhutan, 1,800-7,000 feet. This species has apparently a greater range in elevation than the last, but I have not taken it so frequently. (I took this at Darjeeling and have it also from Manipur. —*H.J.E.*)

1724. *E. albirena*, Moore.

Sikhim. I have only one specimen with no elevation recorded. (Four specimens from Möller's collection, of which one is dated 21st October 1888, probably from low elevation.—*H.J.E.*)

1725. *E. subcurva*, Wlk.

Sikhim, 1,800 feet. This is a rare species in Sikhim; my only specimen was taken by me at light at Punkabaree in April.

1737. *E. metallica*, Wlk.

Sikhim. I have not seen this species. (Sikhim, *Atkinson, Möller* in B. M.—*G.F.H.*) (I have four specimens of this fine species from Atkinson's and Möller's collections.—*H.J.E.*)

1728. *E. discisignata*, Moore.

Sikhim and Bhutan, 6,400-6,700 feet. I took a specimen in September at Rissoom and another in the same month at Pasheteng. (A common species at Darjeeling at light and varies a good deal. I also have it from the Naga Hills.—*H.J.E.*)

1730. *E. chalybeata*, Moore.

Sikhim and Bhutan. I have one specimen of this taken by my collectors in Bhutan, but with no record of elevation or date. (I took this at light on Tonglo and have it also from Möller's collection. —*H.J.E.*)

1732. *E. melanospila*, Koll.

Sikhim and Bhutan, 1,800-7,000 feet. A very common species especially at about 5,000 feet. My specimens are dated May and September.

1733. *E. aurigera*, Wlk.

Sikhim and Bhutan, 2,500-10,000 feet. A common insect attracted to light at many different elevations. I have specimens taken by myself at Tukvar, Badamtam, Fagoo, and Darjeeling in March and June and have received specimens through my collectors from Yatung and the Sikhim frontier.

1734. *E. albinota*, Moore.

Sikhim, 9,000 feet. I have only one specimen taken in the interior in July. (Also taken by me at light on Tonglo in July.—*H.J.E.*)

1734b. *E. chlorogrammata*, Hmpsn.

Sikhim, 1,800 feet. I took one specimen which is now in the British Museum collection as the type at Punkabaree.

1735. *E. auroviridis*, Moore.

Sikhim and Bhutan, 1,800-2,500 feet.—I have only taken this in August and September attracted to light. It is apparently not very common. (The form *albidisca*, Moore which Hampson treats as a synonym, seems to me distinct. I have three from Sikhim and one from the Khasi ♂ which agree with each other.—*H. J. E.*)

1736. *E. literata*, Moore.

Sikhim. I do not know this. (Sikhim, type Moore coll., and *Pilcher* in B. M.—*G. F. H.*) (I have two of this pretty species, one of which I took at light at Darjeeling in July.—*H. J. E.*)

1737. *E. calamistrata*, Moore.

Sikhim and Bhutan, 3,000-5,500 ft. Occurs but not commonly in September and October. (I took it also at Darjeeling.—*H. J. E.*)

1738. *E. aurantiaca*, Hmpsn.

Sikhim, 8,000 feet. I have not seen this. (I have four specimens which came from Möller's collection.— *H. J. E.*)

1739. *E. stellifera*, Moore.

Sikhim and Bhutan, 6,700 feet. An insect which I take to be this species I took at Pasheteng in September.

1741. *E. plumbeola*, Hmpsn.

Sikhim. I do not know this species. I have six specimens from Möller's collection, some dated June. A very distinct species.—*H. J. E.*)

1742. *E. gemmifera*, Wlk.

Sikhim and Bhutan. I have a specimen taken in Bhutan in May. (Not a rare species in some parts of Sikhim, but I never took it myself. —*H. J. E.*)

1743. *E. albovittata*, Moore.

Sikhim and Bhutan, 3,000-7,000 feet. A common insect attracted to light in June, September, October and November. (This agrees with a specimen in Dick's collection from N. Japan. The var. *sinuata*, Moore has much narrower silver bands.--*H. J. E.*)

1744. *E. distorta*, Moore.

Sikhim. I have not seen this. (Sikhim, *Pilcher* in B. M.—*G. F. H.*) (I have only one perfect specimen of this very beautiful species from Knyvett's collection taken 14th May 1889.—*H. J. E.*)

1747. *E. indica*, Moore.

Sikhim. (This cannot easily be identified, but I have one which I took at Darjeeling which I believe to be this.—*H.J.E.*)

1749. *E. pulcherrima*, Moore.

Sikhim. I have only taken this in the Kangra Valley and have specimens from Kulu. It must be rare in Sikhim. (I have several specimens, of which I took two at light on Tonglo.—*H.J.E.*)

1750. *E. atrovirens*, Moore.

Sikhim, 7,000 feet. Two specimens taken at light in July. (Not are at light at Darjeeling.—*H. J. E.*)

1752. *E. venosa*, Moore.

Sikhim. I have not taken this. (Sikhim, *Russell* in B. M.—*G. F. H.*)

1753. *E. confluens*, Moore.

Sikhim. Another insect unknown to me. (Both of the above are unknown to me and must be rare in Sikhim.—*H. J. E.*)

1754. *E. mucronata*, Moore.

Sikhim. (I have three from Möller's and one from Atkinson's collection.—*H. J. E.*)

1755. *E. icamba*, Swinh.

Sikhim and Bhutan, 7,000-10,000 feet. This seems to be not uncommon in July at high elevation, but I have never taken it myself. I have only five examples taken by my collectors. (Quite a common species on Tonglo in July and occurs at Darjeeling also.—*H. J. E.*)

1756. *E. costalis*, Moore.

Sikhim and Bhutan, 6,400 feet. I took two specimens at Rissoom in September. (Two from Sikhim in my collection and two from the Khasias.—*H. J. E.*)

1756*a*. *E. niveifascia*, Wlk. (Plate III, Fig. 27.)

Sikhim. My only specimen was taken by me at light at Punkabaree and is now in the British Museum collection.

1869. *E. ochreipuncta*, Hmpsn.

Sikhim. This is unknown to me. It was included in the genus *Caradrina* until now. There is a specimen from Col. Pilcher's collection in the B. M. (The type fröm Möller's collection agrees with the Khasia specimen.—*H. J. E.*)

1757. *E. viridinigra*, Hmpsn.

Sikhim. I have only one specimen with no record of elevation or date upon it.

1758. *E. cyanolinea*, Hmpsn.

Sikhim, 10,000 feet. I do not know this. (A high elevation species which I took at Tonglo occurs also up to 12,000 feet.—*H. J. E.*)

1758*a*. *E. conservuloides*, Hmpsn.

Sikhim. Described from specimens in Col. Pilcher's collection. I do not know it.

1760. *E. partita*, Moore.

Sikhim, 10,000 feet. (*Pilcher* in B. M.—*G. F. H.*)

1761. *E. lageniformis*, Hmpsn.

Sikhim. (I have four from Möller's and one from Atkinson's collection.—*H. J. E.*)

1762. *E. heterocampa*, Moore.

Sikhim. I do not know any of these last three. (A distinct species which I took on Tonglo at light in July, and which occurs along the Nepal frontier up to 12,000 feet.—*H. J. E.*)

Genus Ancara, Wlk.

1767. *A. rubra*, Hmpsn.

Sikhim, Yatung. I have one specimen from the latter locality with no date. (I have one from Sandukpho, about 12,000 feet, and another from Möller's collection.—*H. J. E.*)

1768. *A. thalpophiloides*, Wlk.

Sikhim, 1,800 feet. I have taken this at light in May, June and July at Punkabaree.

1770. *A. glaucochlora*, Hmpsn.

Sikhim. I do not know this. (I have one from Möller's collection (the type) and three from the Khasias which agree with it.—*H. J. E.*)

Genus Magusa, Wlk.

1771. *M. tenebrosa*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. I have six specimens taken by me at light at Fagoo and Punkabaree which shew great variation in the markings of the forewings. One specimen has a central longitudinal fascia with white patches below it. I have specimens from the Kangra Valley also taken in July and September at 4,500 feet. My Sikhim and Bhutan examples were all taken in July and August.

Genus Eurois, Hübn.

1772. *E. retrahens*, Wlk.

Sikhim. I have not taken this, (I have taken this at Shillong in the Khasia hills, but never saw a specimen from Sikhim and doubt its occurrence there.—*H. J. E.*)

1774. *E. decorata*, Moore.

Sikhim and Bhutan, 6,000-7,000 feet. I have two examples taken by my collectors in July and September. (One of the commonest species at light on Tonglo and extends along the Nepal frontier to 12-13,000 feet.—*H. J. E.*)

1775. *E. separata*, Moore.

Sikhim. I have no specimens of this. (I took two on Tonglo and got another from the same frontier—*H. J. E.*)

1776. *E. simulata*, Moore.

Sikhim and Bhutan, 6,000-7,000 feet. I have a specimen from Lingtu taken in September.—(I have three Möller's collection.—*H. J. E.*)

1835.—*E. monilis*, Moore.

Sikhim. This insect was originally placed under the genus *Amyna* in Moths of India. I have not seen a specimen. (I also have not seen it.—*H. J. E.*)

1780. *E. leucosticta*, Moore.

Sikhim, 10,000 feet. I do not know this. I have nothing that I can identify certainly with this.—*H. J. E.*)

1780*a*. *E. chalcochlora*, Hmpsn. (Plate II, Fig. 9.)

1781. *E. flavipicta*, Hmpsn.

Sikhim. Another insect I have not received. (I have only the type specimen from Möller's collection. It is probably a high-level species.—*H. J. E.*)

1782. *E. fortissima*, Moore.

Sikhim and Bhutan, 2,000-7,000 feet. All my specimens were taken by me at light in September. The male has a curved tuft of long scales each side of the last segment of the abdomen. (I have only two specimens from Atkinson's collection.—*H. J. E.*)

1783. *E. cuprima*, Moore.

Sikhim and Bhutan. I have specimens taken in May and August at about 5,000 feet elevation. It was originally named *chalybeata*, Wlk. in Moths of India. (I believe that I have two species under this name which were taken on Tonglo at light, but I cannot identify them certainly.—*H. J. E.*)

1783*a*. *E. chalybeata*, Wlk.

Sikhim. I do not know this.

Genus DIPTERYGIA, Steph.

1800. *D. nocturna*, Hmpsn.

Sikhim and Bhutan, 1,800-4,000 feet. This is a very common insect, especially at the lower elevations. I have taken it throughout the rains at light at Tukvar, Badamtam, Punkabaree and Fagoo.

1802. *D. sikkima*, Moore.

Sikhim. My only specimen is now in the British Museum collection. (I have specimen from Möller's collection dated 2nd June.—*H. J. E.*)

Genus Acronycta, Ochs.

1813. *A. ancedina*, Butl.

Sikhim, 6,800 feet. I have only one example taken at the electric lamps in Darjeeling in June.

1816. *A. sinens*, Wlk.

Sikhim and Bhutan, 1,800-3,000 feet. I have four specimens, three of which I took at Punkabaree in July, August and October and the other at Fagoo in August. The male differs from the female in having the forewing slightly more prolonged and the hindwing reduced in area, vein 4 being more nearly approximated to 6 and forming a slight fold between them. (I have one only from Möller's collection. —*H. J. E.*)

1819. *A. denticulata*, Moore.

Sikhim, 1,800 feet. I took one female at Punkabaree in July. This sex differs from the male in the hindwing being completely suffused with brown. My specimen otherwise exactly corresponds with Butler's figure in Ill. Het. vii, pl. 125, fig. 8.

1822. *A. fasciata*, Moore.

Sikhim, 1,800 feet. I took one example at light at Punkabaree in July. My specimen is a female and corresponds fairly well with Butler's figure of "*Hyboma divisa*, Moore" in Ill. Het. vii, pl. 125, fig. 7.

1823. *A. obliqua*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. This is the commonest species of the genus which I have taken within these limits. My specimens as present in my collection were taken by me at light at Punkabaree and Fagoo in May, June, July and August. The dark fascia on the forewing from the middle of the costa through the reniform to the centre of the inner margin distinguish it from any other *Acronycta* I have seen.

Genus Toxocampa, Guen.

1826. *T. dorsigera*, Wlk.

Sikhim. (I have a specimen from a high elevation on the Nepal frontier which I cannot distinguish from those from the Khasias and Burmah.—*H. J. E.*)

Genus Conservula, Grote.

1827. *C. indica*, Moore.

Sikhim. I have only taken this twice in Sikhim. My specimens are unfortunately without date or elevation. I took a specimen also in the Kangra Valley, Punjab, in September at 4,500 feet. (I have specimens from Möller's and Knywett's collections, but never took it myself.—*H. J. E.*)

Genus PRODENIA, Guen.

1829. *P. littoralis*, Boisd.

Sikhim and Bhutan, up to 6,000 feet. A common insect attracted to light from June to September.

1829*a*. *P. synstictis*, Hmpsn. (Plate II, Fig. 23.)

Sikhim, 1,800 feet. I took one specimen at Punkabaree in August 1897.

Genus SPODOPTERA, Guen.

1831. *S. mauritia*, Boisd.

Sikhim and Bhutan, up to 5,500 feet. A very common and somewhat variable insect of which I have specimens taken in March and from May to November.

Genus AMYNA, Guen.

1833. *A. selenampha*, Guen.

Sikhim and Bhutan, 3,000 feet up. A variable insect occurring in large numbers in some localities particularly attracted to fruit. I have taken it in June, July and August. One form has a large white spot below the reniform on the forewing.

1833*a*. *A. apicalis*, Moore.

Sikhim and Bhutan, 1,800-2,500 feet. Not uncommon in June, October and November. Occurs in the Kangra Valley also.

1834. *A. octo*, Guen.

Sikhim and Bhutan, 1,800-3,000 feet. Very common with at least three fairly well marked forms, some of which may prove to be distinct. One red form with a sub-apical grey spot on the forewing has the forewing somewhat truncated ; this is probably the form *renalis*, Moore.

Genus BERRESA, Wlk.

1837. *B. turpis*, Wlk.

Sikhim and Bhutan, 1,800-3,000 feet. I have six specimens in my collection taken by me at light in July, September and November at Fagoo and Punkabaree.

Genus CALLOPISTRIA, Hübn.

1838*a*. *C. variegata*, Swinh. (Plate III, Fig. 25.)

Bhutan, 3,500 feet. I took three specimens of this at light at Fagoo in August and September.

1839. *C. strigilineata*, Hmpsn.

Sikhim. I have not seen this. (Two from Möller's collection and one taken by myself near Darjeeling agree together, but differ in being larger, paler and with the apical markings on the forewing somewhat different from two Khasia specimens so named by Sir Geo. Hampson.—*H. J. E.*)

1839*b*. *C. harmonica*, Hmpsn.

Sikhim, 1,800 feet. I took one specimen of the type at Punkabaree at light. It curiously resembles a well-marked specimen of *Caradrina transversa*, Moore.

1842. *C. repleta*, Wlk.

Sikhim, 1,800-3,000 feet. I took this fairly commonly at Punkabaree in May, July, August, September, October and November.

1843. *C. rivularis*, Wlk.

Sikhim and Bhutan, 1,800-3,000 feet. Very common in June, August, September, October, and November at light at Fagoo and Punkabaree. I have two specimens also from the Kangra Valley taken in August at 4,500 feet.

1846. *C. placodoides*, Guen.

Sikhim and Bhutan, 1,800-3,000 feet. Common at light in June, July and August.

1848. *C. indica*, Butl.

Sikhim and Bhutan, 1,800-3,000 feet. I have six specimens taken by me at light in June, July and August at Punkabaree and Fagoo and six more taken in June and July at 4,500 feet in June and July in the Kangra Valley.

1849. *C. recurvata*, Moore.

Sikhim and Bhutan, 1,800-5,500 feet. I have seven specimens of this taken at light in June, July, August and September at Tukvar, Fagoo and Punkabaree.

Genus Elusa, Wlk.

1850. *E. bipars*, Moore.

Bhutan, 2,500 feet. Occurs commonly at Fagoo in July and October. It is distinguishable from *E. antennata*, Moore, by the outer third of forewing being pale reddish brown.

1851. *E. cyathicornis*, Wlk.

Sikhim and Bhutan, 1,800-3,000 feet. Common at Punkabaree and Fagoo. Some specimens have the reniform spot pure white. My specimen I took at light from June to September.

1852. *E. antennata*, Moore.

Sikhim and Bhutan; 1,800-3,000 feet. Common at light from May to September.

Genus CARADRINA, Ochs.

1854. *C. cognata*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. I have taken this at Badamtam, Fagoo and Punkabaree chiefly in June and July. It is not very common.

1855. *C. exigua*, Hübn.

Sikhim, 1,800 feet. I have only two specimens of this insect which I took at light at Punkabaree in March.

1856. *C. kadenii*, Freyer.

Sikhim and Bhutan, 1,800-5,000 feet. I have five specimens of this species taken at light. They were obtained in January, March, June and October. There are generally four conspicuous black specks on the costa, and the reniform and postmedial line are generally defined with ochreous red.

1857*a*. *C. terminata*, Hmpsn.

Sikhim and Bhutan, 1,800-2,500 feet. A very common insect, especially at Punkabaree. It is somewhat like *C. kadenii*, Freyer, but the forewing is always shorter, there are never more than two black specks on the costa, and the area beyond the postmedial line is generally suffused with cupreous fuscous. I have seventeen specimens in my collection taken by me at light in January, March, May, June, July, September and October.

1858*a*. *C. atrescens*, Hmpsn.

Sikhim, 1,800 feet. This species, of which I obtained a number at Punkabaree, is very distinct from anything else I know in the genus. The large quadrate black patch on the costa at the middle and the black patches on the postmedial area combined with the buff-white ground colour give it the appearance of an *Acronycta*. Sir Geo. Hampson thinks this may be referable to the genus *Euplexia*.

1860. *C. delecta*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. This is not uncommon in the winter and spring months at low elevations. I have ten specimens in my collection bearing dates February, March, April, October and November. The orbicular and reniform spots on the forewing are represented by black subquadrate patches divided up by fine pale lines, the former into 5 and the latter into 9 parts.

1867. *C. transversa*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. This is another well-marked species which I have taken commonly at light at Punkabaree and Fagoo from May to September.

1872. *C. picta*, Swinh.

Sikhim. I have not seen this. (I have four specimens from Möller's collection which agree with one from the Khasias. It seems to me that the species included in *Caradrina* differ so widely in fascies that they can hardly be kept under one genus.—*H. J. E.*)

1874. *C. pectinata*, Hmpsn.

Sikhim, 1,800 feet. Occurs rather rarely at Punkabaree in July, September and October. I have also a specimen of a female from the Kangra Valley (Punjab) identified by Sir George Hampson. The male has the antennæ pectinated.

1875. *C. reclusa*, Wlk.

Sikhim, 1,800 feet. I have only two specimens of this rare species. The forewing somewhat resembles that of *C. lineosa*, Moore, but is suffused with ochreous on the basal half, and the collar and abdomen are black.

1876. *C. externa*, Wlk.

Sikhim and Bhutan, 6,700 feet. I have only one specimen that I took at Pasheteng in October. (A single specimen from Atkinson's collection.—*H. J. E.*)

1877. *C. lineosa*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. I have fourteen specimens of this, one of which was wrongly identified by Sir Geo. Hampson as *Radinacra placida*, Moore which is placed as a synonym off *C. quadripunctata*, Fabr. The reniform is generally composed of a round white speck with a smaller one above it, but there is sometimes a third one below as well. In the specimen referred to as identified as *Radinacra placida* the specks are suffused with reddish.

1879. *C. divisa*, Moore.

Sikhim. Sir Geo. Hampson says that this is not from Sikhim in B. M. (I have two from Kynvett's and two from Möller's collection which agree with the type of *divisa*.—*H. J. E.*)

1882. *C. cervina*, Moore.

Sikhim. I have not taken either of these last two. (I have not seen this.—*H. J. E.*)

1883. *C. castaneipars*, Moore.

Sikhim, 6,400 feet. I have only taken this on two occasions. A specimen in my collection is marked "Rissoom September."

1887. *C. fasciata*, Moore.

Sikhim, 6,700 feet. I have two specimens which I took in September and October. (Common at light at Darjeeling. I am not sure that I have not two species under this name.—*H. J. E.*)

1889. *C. indistincta*, Moore.

Sikhim and Bhutan, 1,800-3,000 feet. A very common insect at Punkabaree, but taken only in the cold weather. My specimens are dated January, March, September, November and December. The forewing of this species is much broader than that of other species of the genus, the third joint of the palpus is long, and the collar somewhat peaked. The reniform spot is dark and indistinct, reticulated with lines of the ground colour. The postmedial line sometimes has a series of black streaks between the veins on both sides of it.

Genus TATHORHYNCHUS, Hmpsn.

1890. *T. vinctalis*, Wlk.

Sikhim and Bhutan, 1,800-2,500 feet. Occurs, but not commonly, in June and July attracted to light.

Genus AUCHMIS, Hübn.

1941. *A. intermedia*, Brem.

Bhutan, 6,400 feet. I only took this once at Rissoom, but have specimens from Simla and from the Kangra Valley. (I have only one from Sikhim, where it must be rare.—*H. J. E.*)

Genus NONAGRIA, Ochs.

1943. *N. inferens*, Wlk.

Sikhim, 1,800 feet. This is rare in this locality. I took two specimens at light at Punkabaree in June and October. (I have only seen one from Sikhim taken in August.—*H. J. E.*)

1945. *N. robusta*, Hmpsn.

Sikhim. I do not know this. (I have four of this fine species from Möller's and one from Knyvett's collection. I believe it to be a high-level species.—*H. J. E.*)

1946. *N. submarginalis*, Hmpsn.

Bhutan, 2,500 feet. I have one specimen taken at light in May.

Genus LEOCYMA, Guen.

1958. *L. tibialis*, Wlk.

Sikhim and Bhutan, up to 5,000 feet. A common insect attracted to light in May, June and August.

1959. *L. judicata*, Wlk.

Sikhim, 1,800 feet. I have only one specimen of this. My specimen is without the black costal marks, but has postmedial curved and submarginal straight lines of indistinct fuscous scales. The hindwing has three minute black specks on the subapical margin.

1960. *L. biplaga*, Wlk.

Sikhim. I do not know this. (I took a single perfect specimen of this beautiful and distinct little species at sight at Darjeeling on 20th June 1886.—*H. J. E.*)

1960*a*. *L. pilcheri*, Hmpsn. (Plate II, Fig. 2.)

Sikhim. The type of this was procured by Colonel Pilcher at Darjeeling.

1961. *L. maculata*, Hmpsn.

Sikhim. (I have a specimen taken by Dudgeon which agrees with the type.—*H. J. E.*)

Genus APSARASA, Moore.

1962. *A. radians*, Westw.

Sikhim and Bhutan, 4/5,000 feet. This is a rare species, of which I have only taken three specimens. It occurs in May and June.

Genus COSMIA, Ochs.

1873. *C. ochreimargo*, Hmpsn.

Sikhim, (Pilcher) in British Museum collection. This was originally placed in *Caradrina*. *Cosmia* is in *Acontiinæ* in Moths of India, but is removed to here doubtfully by me. (I took the type of this at Darjeeling at light in August and have two others from Sikhim.—*H. J. E.*)

NOTES ON SNAKES COLLECTED IN CANNANORE FROM 5TH NOVEMBER 1903 TO 5TH AUGUST 1904.

BY CAPT. F. WALL, I.M.S., C.M.Z.S.

(*Read before the Bombay Natural History Society on 16th March* 1905.)

Family TYPHLOPIDÆ.

TYPHLOPS ACUTUS.

This snake is called by the Malabaris "Kooroodan pamboo," "blind-snake," which name is also applied to the Cæcilian *Uræotyphlus oxyurus*. A single adult specimen was brought to me alive on the 2nd December. It wriggled vigorously in my grasp, but made no attempt to bite me.

Family BOIDÆ.

Sub-family BOINÆ.

Eryx conicus.

An extremely common snake, called by the natives "Mandalee." This name is also given by them to Russell's viper, from which they are apparently unable to distinguish it. They are extremely afraid of it, and many have been the entreaties I have received not to handle it. I have had many in captivity, but it is an uninteresting, sluggish reptile, and does not thrive well, usually refusing food. It will sometimes snap at an offending object, but as often takes little or no notice of it, and will even refuse to retract its nose from the glass of its cage when drummed against. Its courage and strength are exemplified by its power of overcoming full-grown squirrels (*Sciurus palmarum*). On two occasions I had captor and victim brought in to me, and one of those snakes only measured 1 foot 4½ inches ! I have often wondered what tactics it can adopt to effect the capture of these very active and comparatively large creatures. These are not the only instances known to me in which squirrels have fallen a prey to this snake. One specimen had swallowed a large frog (*Rana tigrina*). Another of 9½ inches had eaten some small mammal, too digested to identify. It kills its victims by crushing, and I have always found them dead before the snake has begun swallowing. It has a habit, like many other snakes, of crouching or pressing itself to the ground when molested, and this is most noticeable in the hinderpart of the body. Its movements are slow, and it cannot be got to hasten ; on the contrary, if worried, sulks, and remains coiled and stationary. I obtained 36 specimens. The sex is not recorded in 18, and of the remainder 9 were males and 9 females ; 15 were obtained in the driest and hottest months, *viz.*, March and April. In the wet months they were correspondingly scarce, May, June, and July producing only 5 specimens. My largest specimen was 2 feet $4\frac{3}{4}$ inches, and the smallest, which, I believe, was a hatchling, was $8\frac{7}{8}$ inches. The navel involved 5 ventral shields, and 43 intervened between it and the anal. A pregnant female, 1 foot $8\frac{3}{4}$ inches, contained 6 eggs with no trace of embryo on the 7th December 1903.

It is quite common to find some of the sub-caudals divided. The first infralabials sometimes fail to meet behind the symphysial.

Family COLUBRIDÆ.

Sub-family COLUBRINÆ.

Lycodon aulicus.

Called by the natives "Choorrta." Of the 50 specimens collected the sex is not noted in 7, and of the 43 remaining 25 were females and 18 males. The females have longer bodies than the males and, it seems, rather shorter tails.

Ventrals ♀ 192—203. Sub-caudals 55—70.
,, ♂ 177—186. ,, 63—73.

Only 3 specimens exceeded 2 feet in length.

It was fairly abundant throughout the year, but perhaps more so during the dry weather.

I found a gecko ingested on two occasions and a mouse once.

It will be observed that I have recorded in the following table a very fair sequence of events from the reported coition of a pair in November to the appearance of hatchlings in May and June. The smallest mother was 1 foot $6\frac{1}{4}$ inches long. The eggs, from 3—10 in number, were unusually elongate, being often more than twice as long as broad and the largest measured $1\frac{5}{8}$ inches in length. I failed to hatch any of these out in spite of many endeavours. Hatchlings measured from $7\frac{1}{4}$—$7\frac{3}{4}$ inches, or about one-third the length of a large adult. The navel involved 3—4 ventrals, and 20—23 ventrals were interposed between it and the anal. 39 of the 50 specimens belonged to Boulenger's varieties D and E* (the *L. capucinus* and the *L. unicolor* of Boie.), neither of which, however, I think, can claim to be regarded as distinct forms, as I found every gradation between them. In fact, two hatchlings obtained on consecutive days from the same small heap of tiles, and which, I think, may reasonably be considered as members of the same brood, were a good deal dissimilar. The one typical of variety D had 20 conspicuous saffron bars on the body, and an occipital bar; the other, almost typical of variety E, had a few barely perceptible indications of bars on the forebody, and no occipital bar. The colour in all these was lightish brown, of variable shades, like tea and milk, or an unvarnished new cedar pencil, and in almost every specimen the bars were distinctly yellow and not white. The yellow, however, speedily became white in spirit. The bars which numbered as many as 24 on the body involved 1—2 scales vertebrally, and the intervals longest anteriorly 6—10 scales. Seven specimens I referred with some doubt to Boulenger's variety A. This very handsome form constitutes a very distinct variety, and resembled the young krait so closely that I was most careful to assure myself of its identity before handling it. These specimens were so remarkably similar as to leave the impression that they must breed true *inter se.* The colour was chocolate or dark purplish-black, and there were from 11—19 well-defined white bars on the body, involving 2 scales vertebrally, the intervals longest anteriorly involving 12—19 scales. Usually some of the anterior labials were mottled brown, otherwise these shields were uniformly white.

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* Cat. Snakes, Brit. Mus., Vol., I, pp. 353-4.

Many—in fact, most—of my specimens were caught at night by warders at the jail during their rounds, illustrating what is already well known of its nocturnal habit. Many have been caught in the near vicinity of, if not actually in, habitations. I found them agile creatures, displaying sometimes much spirit. I was frequently bitten by them in attempting capture or handling those in captivity. Many specimens, however, when grasped gently—an art in which I am little proficient—displayed little or no vice, and suffered themselves to be handled with impunity. The bite is trifling : it cannot be said to cause pain, though one is sensible of the impress of their teeth on the skin, and sometimes even a minute speck of blood may be discerned at the spot. On one occasion one vibrated its tail vigorously under excitement. I have known it more than once fix itself into rigid coils, so that I could toss it like a bit of knotted cane into the air, without it loosening its folds. Its climbing powers are very remarkable and little inferior to some of the tree-snakes. I have seen it many times clamber with the ease of a lizard up the perpendicular faces of its box, and retain its grasp while stationary in a wonderful manner.

Date.	Variety.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anal.	Præoculars touching frontal.	REMARKS.
21-11-03.	E	♂	1′ 11½″	4½″	181	?	1	No	Anterior chin shields in contact with 4 infralabials. Reported "in copulâ."
23-11-03.	A	♂	1′ 5″	3¼″	184	66	1	Yes	Blackish-purple with 13 very distinct white bars—incomplete white collar.
25-11-03.	A	♀	2′ 2½″	4¼″	200	62	2	No	One temporal right side. 10 ovarian follicles impregnated. 13 white bars on body, on dark purplish-black ground.
28-11-03.	A	♀	2′ 3¾″	4⅛″	203	58	2	Yes	Purplish-brown with 18 white bars body very distinct.
10-1-04.	D	♀	1′ 1⅞″	2¾″	177	70	2	,,	3 postoculars.
15-1-04.	E	♀	...	...	...	...	1	,,	
20-1-04.	D	♀	1′ 6¼″	...	...	...	2	,,	Extracted from a *Bungarus candidus*, contained 4 eggs (1⅜″×⅜″).
4-2-04.	E	♂	1′ 5½″	3½″	177	68	1	Right side	Temporal confluent with 7th labial on right side.
8-2-04.	D	♀	...	...	196	64	1	No	Labials 10 with the 3rd, 4th, 5th and 6th touching eye on right side.
8-2-04.	...		...	...	...	...	...	...	
12-2-04.	D E *	♀	1′ 8½″	3½″	197	63	2	Yes	3 right postoculars; anterior chins touch 4 infralabials; 4th and 5th subcaudals entire. Contained 5 eggs (1⅛″—1$\frac{3}{16}$″).
17-2-04.	A	♀	...	...	...	...	2	,,	10 labials, the 3rd, 4th, and 5th, touching the eye. Contained 5 eggs (1⅛″×$\frac{7}{16}$″).
18-2-04.	D	♂	1′ 7″	3¾″	186	65	1	,,	Anterior chins touch 4 infralabials.
27-2-04.	...	♀	...	...	...	...	...	...	Died 17th March '04. Contained 5 eggs ($\frac{13}{15}$″—$\frac{19}{15}$″).
27-2-04.	D	♀	1′ 8½″	3⅛″	196	59	2	Yes	Contained 4 eggs ($\frac{9}{16}$″ ×⅛″).

* Implies intermediate between D and E.

Date.	Variety.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anal.	Præoculars touching frontal.	REMARKS.
2-3-04.	D E*	♀	$1'\ 7\frac{7}{8}''$	$3\frac{1}{4}''$	...	...	2	Left side	3 impregnated ovarian follicles.
4-3-04.	D E*	♂	...	...	...	...	1	Yes	
5-3-04.	E	♂	$1'\ 8\frac{3}{4}''$	$4\frac{1}{8}''$	...	...	2	„	
7-3-04.	D	...	...	...	...	...	2	...	
11-3-04.	D	♂	...	...	...	...	1	Yes	3 postoculars on right side.
11-3-04.	D E*	♀	...	...	...	...	2	„	Right anterior chin shield touches 4 labials, 5 impregnated ovarian follicles.
12-3-04.	D E*	♂	$1'\ 8\frac{3}{4}''$	$3\frac{7}{8}''$	...	...	2	No	7th labial confluent with temporal.
17-3-04.	D	♀	...	...	...	...	2	Yes	Laid 3 eggs 22nd March 1904 and a 4th on 28th March 1904.
17-3-04.	E	♀	...	...	...	...	2	„	Died 20th April 1904, and contained 4 eggs.
21-3-04.	D	♂	...	...	...	...	2	No	
24-3-04.	D	♂	$1'\ 6\frac{7}{8}''$	$3\frac{7}{8}''$	...	...	1	Yes	
24-3-04.	D	♂	$1'\ 10\frac{1}{2}''$	$4\frac{3}{8}''$	...	...	2	„	
12-4-04.	D	...	...	...	...	...	2	„	
14-4-04.	D	♀	...	...	..	...	2	„	
9-5-04.	A	♀	$1'\ 11\frac{1}{8}''$	$3\frac{1}{4}''$	203	55	2	„	Dark plumjam color with 16 white bars on body.
12-5-04.	E	♂	$1'\ 8\frac{1}{8}''$	$4\frac{1}{16}''$	...	...	2	„	
13-5-04.	D E*	♀	$1'\ 9''$	$3\frac{5}{8}''$	...	...	2	„	
16-5-04.	D	...	$7\frac{1}{8}''$	$1\frac{3}{8}''$	...	...	2	„	Navel involves 4 ventrals, and 23 intervene between it and anal shield.
18-5-04.	E	♀	$1'\ 10\frac{3}{4}''$	$4\frac{1}{16}''$	...	...	2	No	Contained 4 eggs.
18-5-04.	D	♂	$1'\ 3\frac{3}{4}''$	$3''$	...	...	2	Left side	Contained a lizard (Hemidactylus).
19-5-04.	D E*	♂	$1'\ 10\frac{1}{4}''$	$4\frac{1}{4}''$	...	...	2	No	
27-5-04.	A	♀	$1'\ 4\frac{5}{8}''$	$2\frac{1}{8}''$	197	62	2	Yes	19 white bars on body. 8 labials, 3rd and 4th touching the eye on left side.
6-6-04.	D E*	♂	$1'\ 9\frac{3}{8}''$	$4\frac{1}{8}''$	180	65	2	No	Temporal confluent with 7th labial on left side.
7-6-04.	D E*	♂	$1'\ 6''$	$3\frac{3}{4}''$	181	73	2	„	Two loreals, the anterior touching the internasal, parietals divided transversely.

* Implies intermediate between D and E.

Date.	Variety.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anal.	Præoculars touching frontal.	REMARKS.
7-6-04.	D	♀	1′ 2″	2¼″	192	62	2	Yes	Contained a lizard (Hemidactylus frenatus).
10-6-04.	D E*	♀	1′ 11⅞″	3⅞″	196	64	2	No	Contained 6 eggs (about ½″).
10-6-04.	D E*	...	7¾″	1¼″	195	61	2	„	Navel involves 4 ventrals, 23 between it, and anal.
11-6-04.	D	...	7¼″	1¼″	...	...	2	Right side.	Navel involves 3 ventrals, 20 between it and anal, contained a young lizard (Hemidactylus frenatus).
13-6-04.	D	♀	1′ 9½″	4⅝″	197	64	2	No	
22-6-04.	...	♀	...	...	...	...	...	...	Pregnant. Escaped from captivity.
27-6-04.	A	♂	2′ 1⅞″	4⅝″	186	63	2	Yes	Chocolate with 11 white bars.
18-7-04.	D	♀	1′ 9⅞″	3⅞″	194	70	2	„	
19-7-04.	D	♂	1′ 5½″	3⅜″	178	66	1	No	
23-7-04.	D	♀	1′ 11¾″	4″	198	66	2	„	Two loreals on left side, the anterior in contact with the internasal.
3-8-04.	...	...	...	...	...	...	...	...	Contained a mouse.

Lycodon travancoricus.

One specimen only came into my hands. It was a live female measuring 1 foot 5¾ inches, tail 3½ inches, and it allowed me to handle it with impunity. In color it was dark purplish-brown, the dorsal bars and flank reticulations so common among members of this genus were straw coloured. After two days' immersion in spirit the yellow had become white. Ventrals 177. Subcaudals 65, all paired.

POLYODONTOPHIS SUBPUNCTATUS.

I obtained one small specimen, I think a female, 8½ inches long, of which the tail accounted for 2 inches. Ventrals 192. Subcaudals 67. The navel involved 3 shields and 28 intervened between it, and the anal Temporal single, and in contact with the 7th only of the labial series. A cuneate scale is wedged, between the 7th and 8th labials which, if included as a labial, would make these shields number 10.

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* Implies intermediate between D and E.

Oligodon subgriseus.

Natives called this "Choorta," but they confuse it, I think, with *Lycodon aulicus* which is universally called by this name. I got 4 specimens, one live adult was an active, and restless little creature, wriggling constantly from my grasp, but offering no malice. The one caught on the 14th March was evidently a hatchling. It measured $4\frac{13}{16}''$, about quarter the length of a good sized adult. All belonged to var A. (Boulenger)*. The nasals are peculiar, and appear to me to be divided into 3 parts by a Y-shaped suture, the arms of which are wide, and the nostril is slit-like and occupies the anterior arm.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Anal.	Remarks.
25-11-03.	♂	$1'\ 2\frac{3}{4}''$	$2\frac{3}{8}''$	172	46	2	17 bars body, 5 tail.
12- 3 04.	♂	$1'\ 6\frac{3}{4}''$	$3\frac{1}{4}''$	160	47	2	
14- 3-04.	...	$0'\ 4\frac{13}{16}''$	$\frac{3}{8}''$	184	41	2	17 bars body, 5 tail.
10- 7-04.	...	$0'6\frac{1}{16}''$	...	168	...	...	Tail incomplete, 15 bars body.

Zamenis mucosus.

This is called "Chayra" by the natives. Of the 56 specimens, the sex was unrecorded in 19. Of the remainder, 19 were males, and 18 females.

It would appear from the accompanying table that it was most abundant in the cool weather, but this conclusion must be made with reserve, as I discouraged the capture of this species. I think it is probably equally in evidence all the year round.

Frogs, and especially *Rana tigrina*, seemed to form their staple diet.

The only two pregnant specimens were obtained in August and November, the eggs numbering 13 and 11, respectively. Though I have always failed to make one menace me in the open, even when at bay, 2 specimens I had in captivity showed themselves extremely vicious hurling themselves repeatedly against the glass of their cages in their endeavours to strike at me. Both, too, during these outbursts of anger gave vent to a peculiar noise. I have never heard any other snake produce, resembling that scolding sound made by cats when brought to bay. Coincident with this remarkable sound, and probably in some way concerned in its production the neck, and upper body for some inches were markedly compressed, and the throat pouched. If the snake was attentively observed at this time it was noticed that the altered ventral contour with its bulging downwards, corresponded to an equal bulging upwards of the dorsal aspect, which could only have been achieved through an arching of the spine. This snake is active, and has always appeared to me very swift in its movements, and I was much surprised therefore on June 6th when I gave chase to one in full flight measuring 5 feet 9¼ inches and caught it up, and killed it. I paced the ground traversed by both, and found I had run 38 yards whilst the snake covered 18. I frequently encountered it in the paddy fields, and have met as many as 7 in one day. When it took to the water, it kept its head above water, and could rarely be induced to immerse it.

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* Cat., Snakes, Brit. Mus., Vol. II, pp. 243-4.

The male appears to grow to a greater length than the female and this is especially interesting with reference to a remark of Darwin's, who says* he is informed by Dr. Günther that in snakes the males are always smaller than the females. Of the 14 specimens measuring 6 feet and over in which the sex is recorded, 11 were males, and 3 females and the longest male measured 7 feet 6¼ inches against the 6 feet 6 inches of the longest female.

Reference to the following table shows that the scales are subject to much variation :—

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	SCALES.			REMARKS.
						2 headlengths behind head.	Midbody.	2 headlengths in front of vent.	
5-11-03.	♀	6′ 0½″	1′ 10″	200	136	17	16	12	Subocular absent.
7-11-03.	...	...	...	...	...	17	16	14	9 labials, the 5th and 6th touching the eye.
9-11-03.	...	5′ 5¼″	...	...	...	17	17	14	3 postoculars on right side.
10-11-03	...	6′ 6⅞″	1′ 10½″	...	...	17	16	14	4 loreals.
11-11-03.	...	1′ 11½″	0′ 6½″	...	129	17	17	12	
12-11-03.	♂	6′ 2″	1′ 10″	...	...	17	16	14	
12-11-03.	♂	5′ 11½″	1′ 11¼″	...	...	17	17	12	Subocular absent. 3 postoculars on right side.
13-11-03.	♀	5′ 0″	1′ 5½″	...	...	17	17	14	7 labials, the 3rd and 4th touching the eye on left side.

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* "Descent of Man," p. 538.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales.			Remarks.
						2 headlengths behind head.	Midbody.	2 headlengths in front of vent.	
14-11-03.	♀	6′ 0″	1′ 8¼″	...	...	17	17	14	3 postoculars.
14-11-03.	♂	6′ 1¾″	1′ 9¼″	...	...	17	16	14	
14-11-03.	♀	...	...	...	...	17	16	14	2 loreals.
14-11-03.	♀	...	...	...	...	...	...	...	Contained 11 large eggs.
16-11-03.	♀	5′ 2¼″	1′ 6¼″	...	...	17	17	14	
18-11-03.	♀	6′ 6″	1′ 11⅛″	...	...	17	16	13	
18-11-03.	...	...	...	...	...	17	18	14	Subocular absent on left side.
20-11-03.	♀	5′ 6¼″	1′ 6½″	...	...	17	17	12	3 postoculars. Contained a large frog (*Rana tigrina*).
22-11-03.	♂	5′ 7″	1′ 7¼″	...	...	17	16	12	
23-11-03.	♀	4′ 9½″	1′ 4¼″	...	...	17	16	14	
29-11-03.	...	...	...	...	...	...	...	..	
2-12-03.	♂	6′ 11¾″	1′ 11⅝″	...	...	17	16	12	Subocular absent. Contained a large frog (*Rana tigrina*).
5-12-03.	...	...	...	...	...	...	...	...	
6-12-03.	♂	7′ 3″	1′ 11″	...	...	17	16	14	Tail incomplete. Contained a large frog (*Rana tigrina*).
9-12-03.	♂	6′ 8½″	1′ 10″	...	...	17	16	14	
18-12-03.	...	...	...	...	...	17	16	12	
20-12-03.	♀	5′ 5¼″	1′ 7⅜″	..	...	17	16	14	Contained two frogs (*Rana tigrina*).
21-12-03.	...	...	...	...	...	...	...	...	
21-12-03.	...	...	...	...	...	...	...	...	
28-12-03.	...	...	...	...	...	...	...	...	
30-12-03.	♀	5′ 8¾″	1′ 7″	...	...	17	17	14	Contained a frog (*Rana tigrina*), a lizard (*Calotes versicolor*), and a toad (*Bufo melanostictus*).
31-12-03.	♂	...	...	...	...	17	17	12	
25-1-04.	♀	5′ 6¼″	1′ 7¼″	...	...	17	16	14	Ant. chins touch 4 infralabials. Contained a frog (*Rana tigrina*), caudal extremity swallowed first.
7-2-04.	♀	...	...	...	...	...	...	...	
10-2-04.	...	...	...	...	...	...	...	...	
11-2-04.	...	...	...	...	...	...	...	...	
19-2-04.	...	...	...	...	...	17	16	13	
7-3-04.	...	...	...	...	...	17	17·16	14	
11-3-04.	...	2′ 3¼″	0′ 6⅞″	...	...	17	17	12	2 loreals.
18-3-04.	♂	7′ 6¼″	2′ 0¾″	...	...	17	14	12	

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales.			Remarks.
						2 headlengths behind head.	Midbody.	2 headlengths in front of vent.	
23-3-04.	...	...	...	...	...	...	...	...	
30-3-04.	♀	3′ 0⅛″	0′ 9⅞″	...	...	17	17	14	
9-4-04.	...	2′ 6″	...	...	...	...	...	...	
25-4-04.	♂	6′ 10¼″	1′ 11″	...	...	17	17	14	9 labials, the 5th and 6th touching the eye.
3-5-04.	♂	...	...	...	...	17	16	14	3 postoculars left side.
7-5-04.	...	...	...	...	...	17	16	12	2 loreals right side.
16-5-04.	♂	6′ 6¼″	1′ 9½″	...	...	17	14	12	
17-5-04.	♀	3′ 1¼″	0′ 10¾″	...	...	...	...	...	Ate a snake (*Tropidonotus stolatus*) caged with it, 30th May 1904.
21-5-04.	♂	...	...	...	...	17	16	14	
22-5-04.	♂	6′ 10″	1′ 3¼″	...	...	...	...	...	
30-5-04.	♀	5′ 8½″	1′ 8¼″	202	137	17	17	14	
6-6-04.	♀	5′ 9¼″	1′ 7″	200	...	17	16	12	Tail incomplete.
6-6-04.	♂	6′ 6″	...	...	...	17	16	12	7th labial confluent with a posterior temporal.
22-6-04.	♂	4′ 4″	1′ 3¼″	...	...	...	...	...	Killed in act of swallowing a frog.
24-6-04.	♂	7′ 0¼′	1′ 11¼″	196	128	...	...	...	4 loreals on left side. Contained a large rat.
29-6-04.	♂	3′ 1″	0′ 11″	192	132	17	16	14	4th labial subdivided to form a second subocular.
11-7-04.	♂	3′ 11¼″	1′ 2″	195	131	17	17	13	Ant. chins touch 4 labials on right side.
1-8-04.	♀	5′ 9½″	1′ 7½″	197	127	17	17	14	Labials 9 with the 5th and 6th touching the eye on left side. Contained 13 eggs measuring $\frac{23}{20}'' — \frac{24}{20}'' \times \frac{7}{20}'' — \frac{8}{20}''$.

Dendrophis pictus.

The "Villoonee" pronounced more like "Billoonee" of the Malabaris, from, I am told, "Villoo," a bow, and "Ooni," to thrust into. They have some legend about this snake fixing its tail in the ground, and poising on this extremity with its body in the shape of a bow. 6 specimens came into my hands, 5 males and 1 female. The only one

I had alive never attempted to bite me though it struggled vigorously in my grasp. The labials in all were 9 with the 5th and 6th touching the eye.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals	REMARKS.
17-11-03	♀	3′ 5½″	1′ 0⅝″	168	115	
27-11-03	♂	2′ 4½″	0′ 8¾″	176	118	Ant. Chins touch 4 labials on right side.
23- 3-04	♂	3′ 0½″	0′11¼″	168	117	
26- 4-04	♂	3′ 0¼″	0′11¾″	...	...	
13- 5-04	♂	3′ 0⅜″	0′11 ″	...	...	
27- 6-04	♂	2′ 7¼″	0′ 9¼″	170	115	

The scales two headlengths behind the head number 15 in all, midbody 15 in all, two headlengths in front of the vent are 9 in 5 male specimens, 11 in the female.

Tropidonotus stolatus.

This snake is called "Therlian" by the natives.

Of the 50 specimens collected 17 were females, and 20 males. The sex was not recorded in the other 13.

It was far more abundant in the rains, 39 of the specimens being obtained in June and July, whereas in the dry season, it is hardly to be found at all, only 2 specimens were brought me during the four months January to April.

The only two occasions on which I found anything in the stomach frogs had been eaten, and in captivity they ate frogs readily.

Coition was accomplished in the early rains (May and June), and the eggs from 5 to 10 in number were deposited in July and August, hatching as late as November. A hatchling measured 6¼ inches, or about one quarter the length of a large adult. Specimens I caught, and had in captivity allowed themselves to be freely handled, and rarely attempted to bite. Some when flushed evinced alarm by erecting themselves, and flattening the forebody.

All specimens were adorned with blotches or spots of pale blue, or vermilion in the anterior part of the body. Of the 50 specimens 16 were adorned with red, 31 with blue and in 3 this is not recorded. Of the 16 red, 6 were males, 7 females, and 3 unrecorded. Of the 31 blue, 14 were males, 10 females, and 7 not recorded. With reference to the coloration of snakes Darwin* quotes Dr. Günther as having informed him that he could almost always distinguish the male from the female by his more strongly pronounced tints. In this connection the following excerpt from my notebook of June 10th is especially interesting:—A jail warder on the evening of the 9th June encountered and caught 5 specimens of this species in close proximity. The next morning I examined the spot, and ascertained that though no two were actually found together, they were all flushed within 20 to 30 yards of one another, on a piece of ground bare except for a few strips of grass on the bunds of a dried up paddy field. One proved to be a female heavily pregnant with 6 nearly matured eggs, the rest were adult males, I supposed attracted to her in ignorance of her maternal expectations. The female was very brilliantly blotched vermilion on the foreback, and spotted on the belly with the same colour, her throat was bright orange. One male was identical in colouring, another differed by lacking the spots of vermilion on the belly, whilst the other two were unadorned with vermilion. It seems clear, therefore, that in this species the brilliant adornment is not of sexual import, since it is not the prerogative of either sex. A glance too at the accompanying table shows that it is not of seasonal significance. There seems to be little difference in the length of the sexes, or in the relative lengths of the bodies, and tails, but the females have rather fewer subcaudals (62-68) than the males (67-80).

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* "Descent of Man," p. 538.

Date.	Variety.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Remarks.
16-11-03.	Red.	♀	1′ 10½″	5⅛″	...	...	Labials 7, the 3rd and 4th touching the eye on the left side.
21-11-03.	Blue.	...	6¼″	...	...	...	A hatchling ?
2-12-03.	Blue.	...	...	...	...	...	
6-12-03.	Red.	...	...	...	...	...	
11-12-03.	Blue.	...	9½″	2¼″		...	
18-12-03	Blue.	...	...	...	...	...	
29-12-03.	Blue.	...	...	...	...	...	Labials 7, the 3rd and 4th touching the eye on right side.
7-1-04.	Blue.	♀	1′ 8¾″	5¼″	138	68	2 postoculars right side. Temporal confluent with parietal. Ant. Chins touch 4 labials.
19-4-04.	Blue.	♂	...	...	...	...	
22-5-04.	Red.	♀	1′ 6½″	4⅝″	...	...	Ant. Chins touch 4 labials. Contained a frog. 6 ovarian follicles impregnated.
24-5-04.	Blue.	♂	...	...	...	...	Reported found coupled.

Date.	Variety.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
4-6-04.	Blue.	...	...	...	...	...	
9-6-04.	Blue.	...	...	...	...	...	
10-6-04.	Red.	♀	1' 9"	5"	140	68	Contained 6 nearly mature eggs.
10-6-04.	Red.	♂	1' 9"	5$\frac{1}{4}$"	143	75	Tail incomplete.
10-6-04.	Red.	♂	1' 5"	...	140	...	Tail incomplete.
10-6-04.	Blue.	♂	1' 5$\frac{3}{4}$"	4$\frac{1}{2}$"	138	67	
10-6-04.	Blue.	♂	1' 7$\frac{1}{8}$"	4$\frac{3}{4}$"	138	67	
14-6-04.	Blue.	♂	1' 6$\frac{3}{4}$"	4$\frac{7}{8}$"	142	72	4 postoculars on right side.
16-6-04.	Blue.	♀	...	...	...	...	
18-6-04.	Blue.	♂	1 2$\frac{1}{2}$"	...	140	...	Labials 7, the 3rd and 4th touching the eye on left side. Ant. Chins touch 4 labials. 4 specimens brought, 3 escaped.
19-6-04.	Blue.	♂	1' 6"	5"	139	75	Labials 7, the 3rd and 4th touching the eye.
21-6-04.	Red.	♂	1' 3$\frac{3}{4}$"	...	...	...	
21-6-04.	Blue.	♀	1' 5$\frac{1}{2}$"	4$\frac{1}{4}$"	138	65	6 ovarian follicles impregnated.
21-6-04.	Blue.	♀	1' 8$\frac{1}{2}$"	...	...	...	Labials 7, the 3rd and 4 touching the eye on left side. 4 postoculars. 8 ovarian follicles impregnated.
21-6-04.	Blue.	♀	1' 7$\frac{7}{8}$"	4$\frac{3}{8}$"	144	62	Labials 7, the 3rd and 4th touching the eye. Laid 5 eggs 29th July 1904 ($\frac{17}{20}$"—$\frac{18}{20}$" × $\frac{8}{20}$"—$\frac{9}{20}$").
22-6-04.	Red.	...	...	...	...	...	
23-6-04.	Red.	♀	1' 7$\frac{1}{4}$"	...	143	...	10 ovarian follicles impregnated.
27-6-04.	Red.	♂	1' 3$\frac{3}{8}$"	...	138	56	Tail incomplete. Labials 7, the 3rd and 4th touching the eye.
29-6-04.	Red.	♀	1' 9$\frac{1}{2}$"	4$\frac{5}{8}$"	142	62	Labials 7, the 3rd and 4th touching the eye on left side. Ant. Chins touch 4 labials on left side.
4-7-04.	Blue.	♀	...	...	...	...	
5-7-04.	Blue.	♂	1' 5$\frac{5}{8}$"	4$\frac{5}{8}$"	142	74	
5-7-04.	Red.	♀	1' 7 "	4$\frac{1}{2}$"	139	67	Labials 8 with the 4th and 5th touching the eye. Ant. Chins touch 6 infralabials on right side. Contained 7 eggs.
5-7-04.	Blue.	♀	1' 7$\frac{5}{8}$"	4$\frac{3}{4}$"	138	67	Contained 5 eggs.
6-7-04.	Red.	♂	1' 5$\frac{1}{2}$"	3$\frac{5}{8}$"	139	78	
8-7-04.	Blue.	♂	1' 6 "	4$\frac{5}{8}$"	143	72	
9-7-04.	Blue.	♂	1' 6$\frac{1}{8}$"	4$\frac{3}{4}$"	139	74	Labials 7, the 3rd and 4th touching the eye on the left side.
9-7-04.	Blue.	♂	1' 7$\frac{3}{8}$"	4$\frac{7}{8}$"	142	71	
10-7-04.	Red.	♂	1' 5$\frac{3}{8}$"	4$\frac{5}{8}$"	137	71	Tail incomplete. Labials 8, the 4th and 5th touching the eye on left side.

Date.	Variety.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
10-7-04.	Red.	...	...	...	...	...	
15-7-04.	Blue.	♂	1′5″	4⅝″	142	80	Labials 7, the 3rd and 4th touching the eye. Ant. Chins touch 4 labials.
15-7-04.	Blue.	♀	...	...	...	...	
18-7-04.	Blue.	♂	1′6⅞″	4⅞″	140	76	Contained a frog eaten caudal extremity first.
21-7-04.	Red.	♀	1′7¾″	4¾″	141	66	Contained 8 eggs, 7th and 8th labials confluent on left side.
28-7-04.	Blue.	♂	...	...	...	...	
30-7-04.	Blue.	♀	...	...	...	...	Pregnant, died in my absence.
30-7-04.	Blue.	♀	...	...	...	...	Pregnant, discharged eggs later when absent from home on leave.

The scales in all were alike. Two heads lengths behind the head 19; midbody 19; two heads lengths in front of the vent 17.

TROPIDONOTUS PISCATOR.

"Neer Kolee" is what the natives call small specimens. This means "Water fowl" and I notice Oates * mentions this name as applied to at least three ducks in Southern India, the ruddy Sheldrake, the Comb duck, and the Spotbill. Large specimens are called "Neer Mandallee," the latter term apparently being equivalent to "snake".

Of the 39 specimens, 10 had the sex unrecorded, and of the rest 8 were males and 21 females making it appear that females are more numerous. Both my largest specimens were females. Males had longer tails.

Like the last it is most in evidence during and after the rains.

Three specimens had eaten frogs, and on more than one occasion one was brought wriggling on a hook which had been baited with a frog by native urchins. It will be noticed from the following table that eggs were deposited in January, and a hatchling appeared in March.

The scales in all were the same, *viz.*, 2 heads lengths behind the head 19; midbody 19; 2 heads lengths before the vent 17.

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* The Game Birds of India, Part II., pp. 92, 103, 150.

Date.	Sex.	Length.	Tail	Ventrals.	Subcaudals.	REMARKS.
6-11-03.	♂	1′ 6⅜″	?	133	...	Tail incomplete. Contained a small frog.
9-11-03.	...	...	...	...	...	Two specimens.
10-11-03.	...	...	...	...	...	Three specimens.
11-11-03.	♂	2′ 4″	8¾″	...	...	
11-11-03.	♀	...	...	...	...	Bright olive green dorsally, bright crimson in the flanks.
11-11-03.	♀	3′ 2½″	9½″	...	...	Contained a large frog (*Rana tigrina*).
12-11-03.	♂	...	...	...	...	Another specimen sex undetermined.
12-11-03.	♂	...	...	...	...	
12-11-03.	♀	...	...	...	...	Olive brown with very large black spots.
13-11-03.	♀	...	...	...	...	
14-11-03.	♀	...	...	...	...	
17-11-03.	♀	2′ 10″	8½″	...	...	
18-11-03.	♀	2′ 4½″	7½″	...	...	
20-11-03.	♀	2′ 6″	8″	...	...	Dull brown, chequered buff, and blackish.
24-11-03	♀	...	...	...	...	
25-11-03	♂	3′ 1″	11″	...	...	
25-11-03.	♂	2′ 8¼″	10″	...	...	
28-11-03.	♀	...	...	...	...	Another specimen. Sex undetermined.
6-12-03.	...	...	...	...	...	
4- 1-04.	♀	2′ 7⅞″	8⅜″	...	...	Contained 20 nearly mature eggs.
10- 1-04.	♀	3′ 7¼″	10½″	...	...	Deposited 57 eggs, 14th Jan. 1904 in her tin of water.
23- 3-04.	...	...	...	...	...	A hatchling. 4 praefrontals.
29- 3-04.	...	...	...	...	...	
14- 6-04.	♀	...	...	...	...	Sloughed, 19th June 1904 and again 13th July 1904.
15- 6-04.	♀	1′ 2⅜″	3¾″	142	75	
20- 6-04.	♀	1′ 0″	3⅛″	136	74	5th labial transversely divided on right side.
24- 6-04.	♀?	2′ 3⅜″	7¼″	140	73	I failed to discover any trace of ovaries in spite of a long, and careful search.
28- 6-04.	♂	...	...	...	...	
2- 7-04.	♀	1′ 5″	4½″	145	79	
7- 7-04.	♀	1′ 7⅞″	...	...	...	Tail incomplete.
13- 7-04.	♀	2′ 5½″	..	141	...	Tail incomplete. 9 labials, the 4th only touching the eye on left side.
21- 7-04.	♀	1′ 4¼″	4¼″	142	75	
31- 7-04.	♂	1′ 3¼″	4½″	130	81	
2- 8-04.	♀	3′ 7⅛″	9″?	141	...	Tail incomplete. Left praefrontal divided into two. Contained a very large frog (*Rana tigrina*).

Sub-family HOMALOPSINÆ.

CERBERUS RHYNCHOPS.

I obtained 2 female specimens. Of one I noted that it struggled violently in my grasp, wreathing itself round my wrist, and exhibiting considerable strength. Of the other the length was 3 feet 3 inches, tail 6½ inches, ventrals 148, sub-caudals 50 but the tail was not complete. The anterior chins were in contact with 4 infralabials. Scales, 2 heads lengths behind the head 25; midbody 25; 2 heads lengths before the vent 19. It contained a large fish 8 inches in length. Under provocation it hissed loudly, and protruded a whitish tongue in a lazy way. Its mode of progression was very peculiar, and very similar to that recently noted by Flower* in relation to an African viper (*Cerastes Vipera*). During progression it always threw a coil sideways in advance of the head, up to which the head subsequently moved, and before the body was extended, the coil was again thrust forward. It gave the impression that it was moving sideways. As I have noticed before this snake depressed its hinder body when alarmed.

GERARDIA PREVOSTIANA.

My only specimen was obtained on 8th November 1903. It was lying sunning itself in a shallow pool of water, and made no movement when I walked over it snipe shooting. My wife following in my steps discovered it.

Length 19⅝ inches, tail 2½ inches, Ventrals 151, Subcaudals 31, Scales 2 heads lengths behind head 17; midbody 17; 2 heads lengths in front of vent 15. Like all the other Homalopsids occurring in Indian limits except *Hypsirhina plumbea* and *Fordonia leucobalia*, the nasal shields touch one supralabial only, *viz.*, the first. The temporal touches one labial only, *viz.*, the 6th.

Sub-family DIPSADOMORPHINÆ.

DIPSADOMORPHUS TRIGONATA.

This snake coiled itself before striking exactly as I have reported in an earlier volume of this Journal, of the *D. Multimaculata*. A considerable length of the body was raised off the ground and thrown into figure of 8 loops, with the head poised centrally. It struck out viciously under provocation. In captivity I noticed, it rested on branches coiled, as if on the ground, unlike all the other tree snakes with which I am familiar and which lie extended along or across the branches in graceful curves distributing their weight on many points.

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* "The Field," 18th June 1904.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
11-11-03.	...	2′ 1¼″	4¾″	218	83	Labials 9, the 4th, 5th and 6th touching the eye on the right side.
28-11-03.	...	...	...	...	...	
16-3-04.	♂	...	...	...	...	
29-4-04.	...	...	...	...	...	Contained a lizard (*Calotes versicolor*).
12-5-04.	♀	1′ 11⅝″	4¼″	...	...	Contained a lizard (*Calotes versicolor*).
23-5-04.	♀	2′ 6½″	5½″	230	76	Labials 8, the 4th and 5th only touching the eye.
1-8-04.	♀	2′ 2⅝″	4¾″	230	78	

The scales were the same in all specimens, and also in 2 sloughs I found on bushes, 2 heads lengths from head 21; midbody 21; 2 heads lengths before vent 15.

DRYOPHIS MYCTERIZANS.

The "pachola" of the Malabaris. I obtained 49 specimens, the sex was not recorded in 28, and of the rest 15 were females and 6 males. The accompanying table makes it appear commonest in November, but this is not the case as far as I am aware. I had to discourage the natives from bringing it in, it proved so plentiful. I believe it will be found equally in evidence all the year round.

The females appear to grow much larger, my largest male was 4 feet, 4¾ inches, and I obtained 7 females of greater length, the largest being 6 feet and ½ inch. The males had longer tails. The ventrals in the two sexes were about the same, but the subcaudals were much more numerous in the males (166—170) than in the females (137—149).

Lizards proved the favoured article of diet.

My one pregnant specimen contained immature eggs late in July. Two specimens I judged to be hatchlings* were received late in November.

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* Ferguson "B. N. H. S. Jl." Vol. X, p. 6, records the birth of young measuring "about seventeen inches."

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
22 specimens in November of which I record the following :—						
12-11-03.	...	3′ 3½″	1′ 4″	179	174	
12-11-03.	...	3′ 6⅛″	1′ 3¼″	176	144	Temporals 2.
14-11-03.	♀	5′ 7½″	1′ 11¼″	176	140	Temporals 2 on left side. Suboculars 2.
17-11-03	♀	5′ 1¼″	1′ 9⅞″	169	118?	Tail incomplete.
20-11-03.	♂	...	...	170	?	Tail incomplete. Last ventral divided. Temporals 2.
21-11-03.	♂	4′ 4¾″	1′ 9⅝″	...	...	3rd and 4th labials confluent.
22-11-03.	♀	...	...	...	...	Labials 8, the 4th and 5th touching the eye, no subocular, 1 postocular.
23-11-03.	...	1′ 5″	...	...	...	I believe a hatchling.
25-11-03.	...	1′ 6⅞″	7′ ⅛″	...	...	Do.
1-12-03.	♂	3′ 1⅛″	1′ 3″	171	170	
5-12-03.	♀	...	...	...	...	
10-12 03.	?	...	...	...	...	
16-12-03.	♀	4′ 0¼″	1′ 6″	...	...	
20-12-03	♀	...	...	...	...	
20-12-03.	♀	3′ 8¾″	1′ 4¼″	168	145	Labials 9, the 6th only touching the eye.
28- 1-04.	...	...	...	...	...	
29- 1-04.	♀	5′ 0½″	1′ 9¼″	...	...	Last ventral divided.
29- 1-04.	♀	4′ 9½″	1′ 8¾″	...	...	Contained a lizard (*Calotes versicolor*). 1 specimen in February, 2 specimens in March, 5 specimens in April.
21- 4-04.	♀	5′ 3¾″	1′ 11⅞″	...	...	
27- 4-04.	...	1′ 8″	...	...	...	
29- 4-04.	♀	6′ 0½″	2′ 1½″	...	...	Last ventral divided. Labials 7, the 4th only touching the eye on the right side.
27- 5-04.	♂	4′ 4½″	1′ 10¼″	...	...	5 specimens in May.
18- 6-04.	♂	2′ 8″	1′ 0½″	177	166	Last ventral divided. Labials 9, the 6th only touching the eye on the right side.
21- 6-04.	♀	2′ 6¼″	10⅝″	171	147	Anterior chins touch 4 infralabials only. Navel involves 4 ventrals and 9 intervene between it and the anal.
11- 7-04.	♂	2′ 9¼″	1′ 1½″	169	167	Anterior chins touch 4 infralabials only. 2 suboculars. Contained a gecko.
29- 7-04.	♀	4′ 10″	1′ 9⅜″	175	149	Labials 9, the 6th only touching the eye on the left side. Captured in act of swallowing a loriquet (*Loriculus vernalis*). Contained 7 eggs, the largest $\frac{15}{20}$″ with no trace of embryo.
30- 7-04.	♀	2′ 5½″	10⅜″	174	137	

The scales show some variation posteriorly. 2 heads lengths behind the head 15 ; midbody 15 ; 2 heads lengths in front of vent 11 or 9.

Sub-family HYDROPHIINÆ.

HYDRUS PLATURUS.

One female specimen of Boulenger's variety E.* Length 2 feet 6½ inches; tail 3⅝ inches. Ventrals about 339. There were 3 praeoculars on the right side; and 2 on the left. Labials 10 with the 5th only touching the eye. The scales 2 heads lengths behind the head 52; midbody 58; 2 heads lengths in front of vent 51. The 2nd supralabial did not touch the praefrontal on either side. There was a loreal on the left side. There were two small cuneate scales between the frontal, and parietal shields.

DISTIRA GILLESPIÆ.

This rare snake has been already reported, and described by me in the Bombay Natural History Journal, Vol. XV., pp. 723—6.

ENHYDRIS CURTUS.

Evidently quite a common snake on this coast. The anal shield was divided into 4, except where noted otherwise. The praefrontals touched the 2nd labial in all specimens.

I obtained 11 specimens, of which I have tabulated the following :—

Date.	Sex.	Length.	Tail.	Ventrals.	SCALES.			REMARKS.
					2 heads length behind the head.	Midbody.	2 heads length in front of vent.	
9-2-04.	♀	1′ 9½″	2⅛″	165	31·30	37	33	8 supralabials, the 3rd and 4th touching the eye.
11-2-04.	...	1′ 6⅞″	1¾″	194	34	40	38	Labials 8, the 3rd, 4th and 5th touching the eye on right side.
11-2-04.	...	1′ 7¼″	2⅛″	164	30	37	31	Said to have been "in copula" with last.
16-2-04.	♂	2′ 9½″	3½″	159	30	36	32	
16-2-04.	♀	1′ 5½″	1¾″	163	31	37	31	Præfrontals touch 2nd and 3rd labials. Anal 6-fid.
23-2-04.	♂	2′ 5″	2⅞″	15 1	31	35	33	Labials 6, the 3rd and 4th touching the eye. No spinose ventral tubercles.
11-4-04.	♂	2′ 9½″	3¼″	...	30	36	31·32	
7-5-04.	♂	...	...	...	30	36	34	Labials 5 on right side. Anal 6-fid.
5-6-04.	♀	2′ 9½″	3″	183	36	43	39	Labials 7, the 4th only touching the eye. Taken on land close to a backwater 1½ miles from the sea.

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* Cat. Snakes, Brit. Mus., Vol. III, p. 268.

Enhydrina Valakadyen.

Of the 29 specimens collected, the sex is not recorded in 16. Of the remainder there were 5 males and 8 females. Three of the latter were mothers, with young in an advanced state of development, and in the aggregate these contained 19 fœtus, of which 7 were males and 12 females, so that the latter appear to predominate.

It appeared to be equally common near the shores throughout the whole year. I could have obtained them in bucketfuls at any time, but had to discourage the fishermen from bringing them in on account of expense in rewards.

The few specimens that had fed contained fish only, and it was a matter of daily occurrence for sepoys and others fishing off the rocks to pull up their lines with one of these snakes wriggling on the hook. I had 4 pregnant females, on dates indicating that the young 4—9 in number are discharged about January and February. The young were suspended in a pellucid, viscid, fluid, resembling castor oil in colour, and consistency, overlying a mass of yolk, and encapsuled in flaccid, capacious, and completely transparent thin-walled chambers, bearing no resemblance to the eggs of any other snakes I have seen. The embryos were coiled spirally, and occupied that region of the chambers nearest to the vertebral column, and those of the most advanced brood measured from $10\frac{3}{8}$—11 inches. These lived for some minutes after liberation from their enveloping membranes, during which the pulsations of the heart were very obvious. Placed in spirit the males extruded their genitals in the act of dying.

It is evidently of a peaceful disposition. I never excited one to strike at or bite any offending object, and none of the many soldiers and others who habitually bathed in the sea, where they were very plentiful, were ever bitten.

It is extremely tenacious of life, and is most difficult to kill. I kept some specimens alive for ten days, and many left their ghurrahs of water and wandered for days about the flower-pots in a sunken verandah. It was able to make some progression on land in a heavy laboured way. My largest specimen was 4 feet, 7 inches. The smallest pregnant female measured 3 feet 2 inches. The females had a much deeper conformation of body than the males. The male claspers were bifid on each side as in vipers, they were villose, and had a median raphè posteriorly which divided and passed up each limb. The extremities of these organs were not surmounted by tentacles, and were therefore unlike what obtains in most snakes.

My notes on this species are too imperfect to quote *in extenso*, but the following abnormalities are worth mention. The præfrontals were not in contact with the 2nd labial in 7 specimens, including 4 specimens of a brood of 4. The 4th labial did not touch the eye in 7 specimens, including 3 of a brood of 6. The præoculars were 2 in 2 specimens of a brood of 4. The 1st and 2nd labials were confluent in 3 specimens of a brood of 9. The postoculars were 2 in 2 female specimens and in 7 males. It is curious that in the brood of 9 all the males had 2 postoculars, and all the females only 1. In the brood of 6 the same was observed. The frequency of the same abnormality in the same brood suggests its inheritance from one or other parent.

Sub-family ELAPINAE.

Bungarus candidus.

Called " valla pamboo " in this locality. " Valla " I am told means " banglo. " Males were much more numerous than females. The colour of the hatchling was unlike the adults, the white arches being exceptionally distinct. There were 30 distinct linear arches on the body arranged in pairs, and 9 on the tail. Anterior to these were 3 broad white bars involving 2 scales vertebrally, and evidently occasioned by a confluence of a pair of the arches which subsequently occurred as discrete lines. The intervals between the most anterior bars involved 12-13 scales vertebrally. They gradually shortened to implicate 6-8 scales in the back part of the body between each pair. An ill-defined, but very distinct, white oblique streak occupied the temporal region.

I kept two alive for a few days; both I believe must have been injured. They frequently used to nibble one another in a playful way, opening their jaws and shifting their grasp along each other's bodies as though selecting a suitable spot in which to bury their fangs. I could not through the glass of their cage discover any wounds as a result, but the younger died the day after my witnessing this somewhat dubious playfulness on the part of the larger snake. Their lengths were 2 feet 10 inches and 1 foot 7½ inches.

In all the specimens the scales were alike, *viz.*, 2 heads lengths behind the head 15; midbody 15; 2 heads lengths in front of the vent 15.

The supracaudals in all were in odd numbers, a very unusual character in snakes, but occurring with few exceptions where the subcaudals are entire. The enlarged and hexagonal character of the vertebral row was retained, though somewhat modified, in the whole length of the tail as I have remarked in previous notes. All specimens belonged to var. *C.* (Boulenger*) *cæruleus.*

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
13-11-03.	♀	2′10″	3⅞″	217	39	
17-11-03.	♂	1′7½″	2⅜″	216	41	
26-11-03.	♂	3′7″	5″	212	42	
20- 1-04.	?	2′7¾″	3¾″	208	38	Contained a snake (*Lycodon aulicus*) 1 foot 6¼ inches long. Recorded B. N. H. S. J., Vol. XV, p. 706.
17- 3-04.	♂	3′3″	4⅝″	213	43	
23- 6-04.	♂	10½″	1¼″	209	40	I believe a hatchling ; navel involved 3 ventrals, and 20 more intervened between it and the anal shield.

Naia tripudians.

Called by the natives here " Moorookan " and " Sairpoom." From the annexed list the disparity of the sexes will be seen to be vastly in favour of the male.

All specimens were of variety A-*a* of Boulenger,† and almost exactly alike in colour, *viz.*, variegated with wheat colour, and pale dun, distributed with a slight tendency to form transverse bars, especially in the posterior part of the body and tail. These colours were disposed upon the skin and hardly at all on the scales. The head was olive-brown, with some or most of the sutures on the crown black. The hood from before backwards was whitish, merging through cinnamon or rusty red to intense black, which latter was abruptly defined posteriorly. A well-defined, white, black-margined, spectacle-mark centrally and a black crescent and spot laterally. These very elegant hues and marks, confined almost entirely to the skin, showed the snake to great advantage when the hood was erect. There were from 2 to 3 blackish-plumbeous ventral bands anteriorly. The eye was very black, the pupil in some specimens scarcely visible, and in others indicated only by a small arc of the iris being golden.

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* Cat. Snakes, Brit. Mus., Vol. III, p. 369.

† Cat. Snakes, Brit. Mus., Vol. III, p. 381.

The only female was pregnant on 12th February with 16 large, but immature, eggs.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	SCALES.			REMARKS.
						2 heads-lengths behind the head.	Midbody.	2 heads-lengths in front of vent.	
10-12-03.	♂	5′ 3″	$9\frac{1}{4}$″	...	...	27·28	23	15	Tail incomplete.
12- 2-04.	♀	...	...	...	...	27	24	15	Contained 16 eggs(1″ × $\frac{1}{3}$″).
22- 2-04.	♂	...	...	...	...	26·27	25	15	
18- 3-04.	♂	4′ 5″	$8\frac{5}{8}$″	...	...	27·28	23	15	
19- 3-04.	♂	4′ 11″	$9\frac{5}{8}$″	...	...	27	22	15	
21- 3-04.	♂	3′ $7\frac{1}{4}$″	7″	...	...	27	23	15	Contained a frog.
9- 4-04.	...	...	...	...	...	...	...	...	
19- 4-04.	♂	...	...	...	...	26·27	23	15	
3- 5-04.	...	...	...	...	...	...	...	...	
17- 5-04.	♂	...	...	...	...	28	22	15	
20- 7-04.	♂	3′ 7″	$6\frac{5}{8}$″	188	56	31	23	17	

Family VIPERIDÆ.

Sub-family VIPERINÆ.

Vipera russellii.

This is called locally "Măndăllee," and as I have remarked under *Eryx conicus* in this paper, these two snakes are confused by the natives, and both treated with equal dread.

The following table indicates a considerable preponderance of males (10) over females (1).

It appeared to be breeding in the cool weather, and the young were born in May and June. The smallest hatchling was $9\frac{1}{2}$ inches at birth, or about one-seventh the length of a very large adult. In a state of nature, rats proved the favoured article of diet, and my note of May 17th shows that the young subsist on mammals like their parents. The navel involved 4 to 5 ventrals, and from 13-15 separated it from the anal shield.

The smallest I kept alive for a day or two, in a biscuit-box. It was very alert, resented interference of any sort, and struck most viciously at the mice given it, both of which it killed but did not eat. Its hiss was louder than that of an adult dhaman. When grasped, it moved its fangs actively after the manner of vipers in general.

All the four young were encountered in close proximity (300—400 yards) to the Jail Superintendent's house, one actually on one of the pot plants in the verandah. Probably these were members of the same brood.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	SCALES.			REMARKS.
						2 heads-lengths behind head.	Midbody.	2 heads-lengths before vent.	
1-12-03.	♂	3′ 7″	$7\frac{1}{2}''$	164	55	27	31	21	
7-12-03.	♂	3′ 3″	$6\frac{3}{4}$	...	...	27	29·30	23	
14-12-03.	...	...	...	...	...	...	...	...	
15-12-03.	♂	$3'\,9\frac{1}{4}''$	$6\frac{3}{4}''$	...	...	27	29	21	
28-12-03.	♂	$4'\,2\frac{1}{4}''$	$7\frac{7}{8}''$	165	53	27	29	21	Said to have been conjoined with another which escaped.
9- 1-04.	♂	...	...	170	55	27	31	21	Contained a large rat.
17- 2-04.	♂	2′ 11″	$6\frac{1}{8}''$	...	...	27	29	21	Contained a large rat.
17- 3-04.	♂	$2'\,7\frac{1}{2}''$	$5\frac{1}{16}''$	...	...	25	29	23·21	
27- 4-04.	...	...	...	...	...	..	...	...	
15- 5-04.	...	$9\frac{5}{8}''$	$1\frac{3}{8}''$	...	...	...	...	...	
17- 5-04.	...	$10\frac{1}{4}''$	$1\frac{1}{4}''$	...	...	...	...	...	Contained a mouse. Found on a pot plant in verandah.
1- 6-04.	♀	$10\frac{7}{8}''$	$1\frac{1}{2}''$	...	...	...	...	...	Navel involves 5 ventrals, and 13 intervene between it and anal shield.
3- 6-04.	♂	$11\frac{1}{8}''$	$1\frac{5}{8}''$	169	55	...	...	...	Navel involves 4 ventrals, and 15 intervene between it and anal shield. Last 2 subcaudals entire.
21- 7-04.	♂	$2'\,10\frac{3}{4}''$	$5\frac{5}{8}''$	170	57	27	31	22·21	Contained a rat.
30- 7-04.	♂	$1'\,4\frac{7}{8}''$	$2\frac{1}{2}''$	168	56	27	29	21	14 ventrals between navel and vent.

This paper would not be complete without some observations on the weather.

In December 1903 there were thunder showers from the 1st to the 4th instant.

In January 1904 drizzling rain on the 2nd instant.

In February no rain.

In March heavy rain on the 18th, and a shower on the 20th.

In April, showers on the 1st, 9th, 21st, 24th to 26th, and 29th to 30th.

In May heavy rain (the commencement of the "*barra barsat*") on the 11th continuing throughout the month with a rainfall of 12·65.

June heavy rain throughout the month registering 55·38 inches.

July heavy rain throughout the month, with a break between the 25th and 30th. Rainfall amounted to 39·36 inches.

In all, 377 specimens were collected including 21 species.

With the exception of a few rarities the sex was ascertained by actual dissection, so that the pregnant specimens recorded were without doubt the only ones in this state. I think tabulated notes such as I have appended with most of the above species would, if carefully kept, throw a good deal more light upon these creatures than might appear at first sight. Many deductions of an entirely unexpected character may be drawn from some such system, but a much larger number of statistics are necessary to establish correct information, and I appeal to those interested in the subject to contribute what they can in this manner. As an illustration of the unexpected I will give another extract from my note book, selecting *Bungarus fasciatus* for my purpose.

It will be seen from the following table that most of the specimens were obtained in the month of July, and I must mention they all were caught about the Jail at Insein near Rangoon, except one in Rangoon itself. If their measurements be carefully studied, it will be seen that they fall into groups according to their lengths: thus 4 specimens ranged between 1 foot 5¾ inches and 1 foot 9 inches; 2 specimens between 2 feet 4¼ inches and 2 feet 7 inches; 3 specimens between 3 feet 7 inches and 3 feet 11 inches, and 1 specimen was 4 feet 5⅝ inches. It certainly appears to me that these must represent the offspring of successive years, in which case one may deduce that the rate of growth for this species is proximately one foot a year. Now the length of a hatchling and the length of a pregnant specimen would allow one to judge the age at which they acquire maturity. It is to be regretted that the sexes in this very interesting series were not investigated, and I frequently have to deplore similar gaps in past notes which are badly needed to confirm or refute conclusions drawn :—

Bungarus fasciatus.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	REMARKS.
?-7-99	...	1′ 7½″	1¾″	216	32	Postoculars confluent with supraoculars.
?-7-99	...	1′ 7½″	1⅞″	215	33	
?-7-99	...	2′ 7″	3⅛″	215	32	Anterior chins touch 4 infralabials.
3-7-99	...	3′ 8″	4″	216	33	
8-7-99	...	3′ 7″	3⅞″	214	32	
8-7-99	...	1′ 9″	2⅛″	210	34	
8-7-99	...	1′ 5¾″	1¾″	208	36	
10-7-99	...	3′ 11″	4″	221	30	Anterior chins touch 4 infralabials.
15-7-99	...	2′ 4¼″	3⅜″	216	35	Anterior chins touch 4 infralabials.
31-8-99	...	1′ 10″	2⅛″	218	31	
31-8-99	...	2′ 0½″	2⅜″	217	32	
?-9-99	...	4′ 5⅜″	4⅞″	216	34	Anterior chins touch 4 infralabials.
?-9-99	...	...	...	...	...	
14-6-00	♂	3′ 11″	4⅝″	...	...	
24-6-00	...	5′ 9″	5⅝″	...	...	

ON FISHES FROM THE PERSIAN GULF, THE SEA OF OMAN, AND KARACHI, COLLECTED BY MR. F. W. TOWNSEND.

(With 3 Plates.)

By C. Tate Regan, B.A.

(Read before the Bombay Natural History Society on 16th March 1905.)

Mr. F. W. Townsend, who has, within the last few years, presented to the British Museum several collections of fishes from the Persian Gulf, the Mekran Coast and Karachi, and also some specimens dredged, at considerable depths in the Sea of Oman, has again collected a large series at these localities and also at Muscat.

This contains examples of 18 species which are described below as new to science. I have added complete lists of the Fishes of the Persian Gulf and the deep-sea forms from the Sea of Oman which have been received from Mr. Townsend. In the case of those from Muscat, I have given only those species which do not appear in Steindachner's recent list (Denkschr. Ak. Wien., lxxi, 1902, p. 123), whilst a list of those from the Mekran Coast is being published in the Imperial Baluchistan Gazetteer.

Willey (Zool. Results, vi, p. 719, 1902) has noted the vertical position of *Amphisile* when swimming, and gives a figure representing it with the head upwards. One may feel inclined to suspect the correctness of this figure in view of the following interesting observation of Mr. Townsend on specimens of *A. strigata* (Gthr.) :—" Some of them were sufficiently alive when dredged to swim in a tub of water, the position they took up being head down, and they swam about in a vertical position using the three fins near the tail to propel themselves, the middle fin seeming to have the most business to do."

Mr. Townsend writes that Mr. and Mrs. Whitby Smith have taken great interest in his collecting, and I have named two new species, *Percis Smithii* and *Callionymus margaretæ*, in their honour.

1. DESCRIPTIONS OF NEW SPECIES.

HEMIRHAMPHUS SINDENSIS.

Depth of body about $1\frac{2}{5}$ times its breadth and $9\frac{1}{2}$ times in the length (without caudal); length of head $2\frac{2}{5}$ times. Diameter of eye $1\frac{1}{3}$ times in the postorbital part of head and nearly equal to the interorbital width. Length of lower jaw in front of the termination of the upper jaw a little longer than the rest of head; upper jaw as long as broad;

præorbital a little deeper than long. Dorsal 14; anal 15; both scaly and commencing nearly opposite each other; pectoral as long as distance from posterior margin of operculum to anterior edge of pupil; origin of ventrals equidistant from anterior edge of præoperculum and base of caudal; caudal forked. Scales deciduous, 50-55 in a longitudinal series. A silvery stripe on the side becoming broader posteriorly.

Length, to base of caudal, 188 mm.

A single specimen from Karachi.

APOGON HOLOTÆNIA.

Depth of body nearly equal to length of head, $2\frac{3}{4}$ times in the length (without caudal). Snout $\frac{3}{5}$ as long as eye, the diameter of which is $2\frac{3}{4}$ times in the length of head, interorbital width about 5 times. Lower jaw slightly projecting; maxillary extending to below posterior edge of pupil. Outer edge of præopercle, suborbital ring and supraclavicle finely serrated. Dorsal VII, I 9. Anal II 8. Second dorsal spine $\frac{2}{5}$-$\frac{1}{2}$ the length of third, which is stronger and slightly longer than the fourth and equal to $\frac{1}{2}$ the length of head; second anal spine $\frac{1}{3}$ the length of head; soft dorsal and anal with outer edges emarginate; pectoral extending slightly beyond, ventral nearly to origin of anal; caudal notched, with rounded lobes. 25-26 scales in a longitudinal series. Caudal peduncle $1\frac{1}{2}$ times as long as deep. Head and body with longitudinal black stripes; a median one from between the eyes nearly to origin of spinous dorsal; on each side one from the snout, running above the eye and the lateral line to the caudal peduncle; a second from the upper part of eye running below the lateral line to below the soft dorsal; a third from tip of snout through the eye and along the middle of the side to the extremity of the caudal; a fourth from tip of lower jaw through the base of pectoral to the caudal peduncle; faint traces of a dusky stripe at the base of both soft dorsal and anal.

Length, to base of caudal, 44 mm.

Three specimens from Muscat, 15-30 fathoms.

This is the species figured by Day* as *A. endekatænia* (Blkr.) and which Bleeker considered to be identical with *A. fasciatus* (White). Several species have been confounded under this latter name, which differ from each other not only in form and proportions, but also constantly in the arrangement of the stripes on the body. The British Museum possesses examples of the true *A. fasciatus* from New South Wales and also from Dr. Bleeker's collection. This is the species figured by Bleeker †. In it the middle lateral stripe forms a large blotch on the base of the caudal fin, the upper lateral stripe is strongly curved above and quite distinct from the lateral line, and the stripe between them is short, extending only from the eye to the edge of the operculum.

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* Fish. India, pl. XVI, fig. 7 (? fig. 4 also).

Apogon balinensis (Blkr.) has been figured by Günther ‡; the middle stripe extends to the end of the middle caudal rays, the upper lateral stripe is nearly straight, and there is no stripe between these two.

Apogon novemfasciatus (C. V.) has also been figured by Günther §; it is very similar in coloration to *A. balinensis*, but the stripes are broader, and end at the base of the caudal.

APOGON MELANOTÆNIA (Pl. III, fig. 4).

Depth of body $2\frac{2}{3}$-3 times in the length (without caudal); length of head $2\frac{3}{4}$ times. Snout $\frac{3}{5}$ as long as the eye, the diameter of which is $2\frac{3}{4}$-3 times in the length of head, interorbital width $4\frac{1}{4}$ times. Lower jaw shorter than the upper; maxillary extending to below posterior edge of pupil. Outer edge of præoperculum and suprascapula serrated. Dorsal VII, I 9, Anal II 8. Dorsal spines stout, the second $\frac{1}{2}$ as long as the third, which is a little longer than the fourth and more than $\frac{1}{2}$ the length of head; second and spine $\frac{2}{5}$ the length of head; outer edges of soft dorsal and anal straight or slightly emarginate; pectoral and ventral extending to origin of anal; caudal notched, with rounded lobes 23-25 scales in a longitudinal series. Caudal peduncle $1\frac{1}{2}$-$1\frac{2}{3}$ times as long as deep. Body with longitudinal blackish stripes which are, anteriorly, broader than the spaces between them; a median one from between the eyes to the spinous dorsal, dividing to run on each side below the bases of the dorsal fins and reuniting on the upper part of the caudal peduncle; the second, slightly curved, from above the eye to the upper part of the root of the caudal; the third from the upper part of the eye to below the second dorsal; the fourth from the eye along the middle of the side, ending in a spot at the base of the caudal; the fifth from the snout through the lower part of the eye and the base of the pectoral to the lower part of the root of the caudal; the sixth from the lower jaw to the anal; a blackish stripe on the basal part of both soft dorsal and anal fins.

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† Atlas Ichthyol., VIII, pl. 48, fig. 4.

‡ Fische Südsee, pl. XX, fig. B.

§ l. c. fig. A.

Length, to base of caudal, 73 mm.

Nine specimens, from Charbar, Mekran Coast, from Karachi, from the Nicobars (Day Coll.) and from Zanzibar (Playfair Coll.) This species is closely allied to *A. fasciatus* (White) and *A. endekatœnia.* (Blkr.), differing from both in the arrangement of the stripes, the wider interorbital space and the included lower jaw.

Apogon spilurus (Pl. III, fig. 5).

Depth of body about 2$\frac{3}{4}$ times in the length (without caudal), length of head 2$\frac{3}{5}$-2$\frac{2}{3}$ times. Snout shorter than eye, the diameter of which is 2$\frac{3}{4}$ times in the length of head and greater than the interorbital width. Maxillary extending to below posterior edge of pupil; lower jaw scarcely projecting. Outer edge of præoperculum serrated; other bones of the head entire. Dorsal VII, I 9. Anal II 8. Dorsal spines rather slender, the second about half as long as the third, which is somewhat stronger but not longer than the fourth; longest dorsal spine about $\frac{1}{2}$ the length of head; second anal spine $\frac{1}{3}$-$\frac{2}{5}$ the length of head; soft dorsal and anal with their outer edges emarginate; pectoral extending a little beyond, ventral nearly to origin of anal; caudal notched, with rounded lobes. 26 scales in a longitudinal series. Caudal peduncle 1$\frac{1}{3}$-1$\frac{1}{2}$ times as long as deep. A blackish longitudinal stripe from the snout through the eye to the edge of the præoperculum; a blackish spot on each side at the base of the caudal, usually above the lateral line and sometimes confluent dorsally with its fellow; a blackish stripe along the base of the anal.

Length, to base of caudal, 50 mm.

Five specimens from Karachi.

This species bears a considerable resemblance to the Japanese *A. notatus*, which is at once distinguished by the strongly projecting lower jaw.

Apogonichthys nudus (Pl. III, fig. 6).

Depth of body about 3$\frac{2}{3}$ times in the length (without caudal), length of head nearly 3 times. Snout shorter than the diameter of eye, which is $\frac{1}{3}$ the length of head and greater than the interorbital width. Cleft of mouth very oblique, the maxillary extending to below the anterior $\frac{1}{4}$ of eye, the lower jaw projecting. None of the bones of the head serrated; præoperculum with posterior edge slightly emarginate and angle rounded. Dorsal VI, I 9. Anal II 11. Dorsal spines feeble, the second or the second and third the highest; soft dorsal and anal with slightly emarginate outer edges; pectoral extending beyond origin of anal, ventrals to the vent; caudal notched, scales deciduous. Caudal peduncle twice as long as deep. A blackish line along the middle of the side from the operculum to below the end of the soft dorsal; fins immaculate.

Length, to base of caudal, 44 mm.

Nine specimens from Karachi.

Very closely allied to *A. gracilis* (Blkr.), which has II 12-13 anal rays, the first dorsal spine the highest, and the dark lateral stripe extending from the snout to the caudal.

CIRRHITICHTHYS CALLIURUS (Pl. II, fig. 3).

Depth of body about $2\frac{1}{4}$ times in the length (without caudal), length of head $3\frac{1}{4}$-$3\frac{1}{2}$ times. Snout as long as the eye, the diameter of which is $3\frac{2}{3}$ times in the length of head, and a little greater than the interorbital width. Maxillary extending to below anterior $\frac{1}{4}$ of eye; præorbital entire, its depth $\frac{2}{3}$ the diameter of eye; præoperculum strongly serrated; supraclavicle serrated. Dorsal X 12, the fifth or sixth spine the longest, more than $\frac{1}{2}$ the length of head; the first soft ray produced, reaching the caudal when laid back. Anal III 6, the second spine the longest, as long as longest soft rays and nearly $\frac{3}{5}$ the length of head. Pectoral with 7 simple rays, extending a little beyond origin of anal; ventral extending to origin of anal; caudal truncate or slightly emarginate. 41-43 scales in a longitudinal series; 4-$4\frac{1}{2}$ between first dorsal spine and lateral line; vertical fins covered with scales in their basal halves. Brownish, marbled with darker, the soft dorsal and anal and the caudal peduncle almost blackish; caudal fin pale yellowish, sharply separated from the dark colour of the caudal peduncle, with a pink tinge at the base, a dark posterior margin and a few dark spots.

Length, to base of caudal, 85 mm.

Two specimens from Muscat, 15-30 fathoms.

PLATYCEPHALUS NIGRIPINNIS (Pl. I, fig. 2).

Depth of body 6 times in the length (without caudal), length of head 3 times. Snout scarcely longer than the eye, the diameter of which is $4\frac{1}{4}$ times in the length of head, interorbital width $7\frac{1}{2}$ times, breadth of head $1\frac{3}{5}$ times. Maxillary extending to below anterior $\frac{1}{4}$ of eye. Upper surface of head flattish, with ridges not or very feebly serrated and not distinctly spinate. Præoperculum with 3 spines, the upper 1⅓ times in the distance from its base to the eye. Dorsal IX, 12, the third spine slightly longer than the second or fourth and nearly ½ the length of head; soft dorsal highest anteriorly, the second ray as long as the longest spine. Anal 12. Pectoral extending ½ the distance from its base to origin of anal, ventral a little beyond origin of anal. Caudal truncate. 80 scales in a longitudinal series; only the anterior 10-12 scales of the lateral line distinctly spinate. 5 or 6 indistinct dark blotches or bars on the side of the body; fins blackish, the anal pale at the base and with a narrow light edge.

Length, to base of caudal, 165 mm.

A single specimen from Muscat, 15-30 fathoms.

Platycephalus townsendi (Pl. I, fig. 1).

Depth of body 7 times in the length (without caudal), length of head 3 times. Snout 1⅙-1¼ times as long as eye, the diameter of which is 4½ times in the length of head, interorbital width 9-10 times, breadth of head 1⅔ times. Maxillary extending to below anterior ¼ of eye; upper surface of head with weakly serrated ridges bearing very indistinct spines. Præoperculum with 3 spines, the upper 1⅓ times in the distance from its base to the eye. Dorsal IX, 12, the third spine nearly ½ the length of head; soft dorsal highest anteriorly, the second ray as long as the longest spine. Anal 12. Pectoral extending ½ the distance from its base to origin of anal, ventral a little beyond origin of anal. Caudal truncate. 53-56 scales in a longitudinal series; only the anterior 16-20 scales of the lateral line distinctly spinate. Brownish: some darker spots or bars on the cheek; base of the operculum blackish; the naked area above the pectoral and covered by the opercular flap is white, with black vermiculations. Spinous dorsal blackish, the spines spotted; soft dorsal with about 5 longitudinal series of spots on the rays: caudal and ventral blackish, with obscure spots, anal pale or dusky; pectoral barred with spots.

Length, to base of caudal, 157 mm.

Two specimens: Karachi; Muscat.

Platycephalus maculipinna (Pl. I, fig. 3).

Depth of body 7½-8 times in the length (without caudal), length of head 3-3⅓ times. Snout 1¼-1½ times as long as the eye, the diameter of which is 4⅓-5¼ times in the length of head, interorbital width 8 times, breadth of head 1⅗-1⅔ times. Maxillary extending to below anterior ¼ of eye. Upper surface of head with ridges bearing some short spines at intervals, but not serrated, except the supraorbital ridge, which has 3 or 4 teeth. Præoperculum with a strong spine at the angle, as long as its distance from the orbit ; below it a short spinous projection and sometimes another weaker one below that. Dorsal IX, 12 ; the third or fourth spine the highest, nearly $\frac{1}{2}$ the length of head ; soft dorsal highest anteriorly, the first ray as long as the longest spine. Anal 13. Pectoral extending $\frac{1}{2}$ the distance from its base to origin of anal, ventral to origin of anal. Caudal truncate. 100-104 scales in a longitudinal series ; lateral line spinate for its whole extent. Spinous dorsal with a large black blotch between the sixth and eighth spines ; soft dorsal with small dark spots on the membrane in front of each ray ; caudal blackish, with a pale lower edge ; anal pale, immaculate ; pectoral with small dark spots ; ventral blackish, with a narrow white edge.

Length, to base of caudal, 190 mm.

Three specimens from Muscat, 15-30 fathoms.

LEPIDOTRIGLA OMANENSIS (Pl. II, fig. 2).

Depth of body $3\frac{1}{3}$-$3\frac{3}{5}$ times in the length (without caudal), length of head $2\frac{2}{5}$ times. Snout a little longer than eye, the diameter of which is $3\frac{1}{3}$-$3\frac{2}{3}$ times in the length of head and equal to the depth of the præorbital. Interorbital width 5 times in the length of head. Maxillary extending to vertical from anterior margin of eye or a little beyond. Snout with a pair of short strongly divergent pointed processes, with entire or minutely denticulated edges ; interorbital space strongly concave, and with a well-marked transverse groove behind it. Dorsal VIII, 14 ; the second and third spines the longest, less than $\frac{1}{2}$ the length of head. Anal 14. Pectoral extending to above 5th ray of anal, ventral to origin of anal. Caudal slightly emarginate. Scales feebly ciliated, those of the lateral line unarmed ; 53-57 scales in a longitudinal series, $2\frac{1}{2}$ series above the lateral line ; 21-23 spiny plates along each side of the bases of the dorsal fins. Inner surface of pectoral black, without white spots but with a white margin which is broadest below ; spinous dorsal blackish posteriorly ; other fins immaculate.

Length, to base of caudal, 88 mm.

Three specimens from the Sea of Oman at a depth of 180 fathoms.

In the allied *L. spiloptera* (Gthr.) the outer edges of the præorbital spines are parallel instead of divergent as in this species, whilst the number of fin-rays is different.

Percis Smithii.

Depth of body 6 times in the length (without caudal), length of head 4 times. Snout shorter than eye, the diameter of which is 3-3$\frac{1}{4}$ times in the length of head and nearly 3 times the interorbital width. Maxillary extending to below anterior edge of pupil. Præoperculum denticulated ; suboperculum finely serrated. Dorsal V, 22 ; the fourth spine the longest, more than $\frac{1}{3}$ the length of head and more than twice as long as the fifth. Anal 19. Caudal slightly emarginate. Pectoral as long as the distance from anterior edge of eye to extremity of opercular spine. Ventrals extending to the vent. 60 scales in a longitudinal series. Brownish (in spirit) with traces of darker blotches or bars on the side ; spinous dorsal pale ; soft dorsal with two rows of white spots ; caudal with undulating alternate light and dark cross-bars and with a pair of dark spots near the base ; pectoral pale, with a dark axillary blotch ; ventral pale, with the innermost ray blackish ; anal pale, immaculate.

Length, to base of caudal, 113 mm.

Two specimens from Muscat, 15-30 fathoms.

Callionymus persicus (Pl. III, fig. 1).

Depth of body 6$\frac{2}{3}$-7$\frac{2}{3}$ times in the length (without caudal), length of head 3$\frac{1}{4}$-3$\frac{3}{5}$ times ; breadth of head 4-4$\frac{1}{2}$ times. Diameter of eye 3-3$\frac{1}{2}$ times in the length of head ; eyes contiguous ; gill-opening small, superior ; præopercular spine straight, with serrated inner edge and a forwardly directed spinous process at its base. Lateral line single. Dorsal IV, 9 ; the anterior fin, in the male, elevated, and with the rays produced as filaments, in the female lower and with the rays not produced ; rays of the second dorsal equal, the last reaching the base of caudal when laid back. Anal 8, the posterior rays the longest. Ventrals extending to pectorals beyond origin of anal. Caudal, in the male, elongate, as long as the fish, in the female about $\frac{1}{3}$ as long. Body with 4 or 5 irregular dark cross-bands and with dark mottlings and light spots. Males with a V-shaped or heart-shaped blackish blotch on the throat, on each side of which alternate light and dark longitudinal stripes separated by narrow white lines extend back from the apex of the lower jaw over the gill membranes on to the ventral fin. Anterior dorsal dark, with undulating oblique white lines and with a small black spot at the upper margin just behind the second ray ; second dorsal with 3 or 4 rows of oblong dark spots ; anal with a blackish band on its outer half, which is continued on the lower part of the caudal ; caudal with several vertical series of oblong dark spots.

Length, to base of caudal, 56 mm.

Twelve specimens from the Persian Gulf, from the Mekran Coast and from Muscat.

CALLIONYMUS MARGARETÆ (Pl. III, fig. 3).

Depth of body 8 times in the length (without caudal), length of head 3-3⅓ times, breadth of head 4 times. Diameter of eye 2⅔ times in the length of head ; eyes contiguous; gill—opening small, superior; præopercular spine straight, with serrated inner edge and a forwardly directed spinous process at its base. Lateral line single. Dorsal IV, 9 ; the anterior fin, in the male, with the first ray produced into a filament ; second dorsal with the rays equal, the last reaching the base of caudal when laid back. Anal 8, the posterior rays the longest. Ventral extending beyond origin of anal. Caudal, in the male, elongate, as long as the fish. Body with dark spots and markings ; a blackish oblong or triangular patch on the throat (in the male) ; anterior dorsal blackish, with white bars anteriorly and white spots posteriorly ; second dorsal with 3 or 4 rows of oblong dark spots ; anal with a blackish marginal band, which is continued on the lower part of the caudal ; caudal with vertical series of oblong dark spots.

Length, to base of caudal, 47 mm.

Two specimens (males) from Muscat, 15-30 fathoms.

Very similar to *C. persicus*, but with a larger eye and without the elevated anterior dorsal and the striped throat of the males of that species.

CALLIONYMUS MUSCATENSIS (Pl. III, fig. 2).

Depth of body 7 times in the length (without caudal), length of head (to gill—opening) 3⅓ times. Eyes contiguous, their diameter ½ the length of head ; gill—opening in front of the upper edge of the base of pectoral ; præopercular spine straight, with both outer and inner edges denticulated, the inner edge with 5 teeth, the outer with 3 or 4, the anterior of which is directed forwards. Dorsal IV, 8 ; the anterior fin elevated and its rays produced in the male ; caudal, in the male, elongate, nearly ⅔ the length of the fish. Anal 8, the last ray elongate in the male. Greyish, with darker markings; caudal with dark cross-bars or series of spots ; anal with a dark margin; dorsal fins, in the male, blackish; in the female, anterior dorsal with a large oblong black spot between third and fourth rays; second dorsal with series of spots on the rays.

Length, to base of caudal, 35 mm.

Two specimens from Muscat, 15-30 fathoms.

This species approaches the genus *Vulsus* in the structure of the præopercular spine.

BLENNIUS PERSICUS (Pl. II, fig. 1).

Depth of body nearly equal to length of head and 5-5⅔ times in the length (without caudal). Diameter of eye about ¼ the length of head and twice the interorbital width. Snout nearly vertical; cleft of mouth extending to below posterior margin of eye. No canine teeth. A pair of well-developed simple tentacles inserted close together on the occiput and a pair of smaller simple tentacles at the anterior nostrils; no supraorbital tentacles; no occipital crest. Dorsal XII, 20; the spinous portion composed of flexible spines, the longest ⅔ the length of head, the twelfth much shorter, about ½ the length of the longest ray, which is ¾ the length of head; a notch between the two dorsals; last dorsal ray connected by a membrane to the procurrent rays of caudal. Anal 23. Caudal truncate rounded. Pectoral slightly longer than head, extending to origin of anal. Sides of body with 6 obscure dark blotches or bars and anteriorly with 4-6 vertical whitish stripes which extend across the abdomen below, posteriorly with small white spots; spinous dorsal with 3 dark bars, running obliquely forwards and upwards, confluent at the margin and below continuous with those of the body; second dorsal dusky, with oblique white stripes running backwards and upwards and breaking up into spots near the margin; caudal dusky, barred with white spots; anal with blackish marginal and light intramarginal bands.

Length, to base of caudal, 72 mm.

Three specimens from the Persian Gulf, 10-20 fathoms.

SALARIAS ANOMALUS (Pl. II, fig. 4).

Depth of body nearly equal to length of head and 4½-5 times in the length (without caudal). Diameter of eye nearly ¼ the length of head and twice the interorbital width. Forehead projecting beyond the snout; cleft of mouth extending to below posterior margin of eye. No canine teeth. Anterior nostrils with a pair of well-developed simple tentacles, which arise almost at the orbital margin in front of the middle of the eye; no supraorbital or occipital tentacles, no occipital crest. Dorsal XII, 19-20, the spinous portion composed of flexible spines, elevated, the longest spines in some examples (? females) less than the depth of body, in others (? males) produced, more than the depth of body; second dorsal low, the last ray attached by a membrane to the caudal peduncle anterior to the procurrent caudal rays. Anal 23-24. Caudal rounded, but with the outer rays produced, giving a trilobed appearance. Pectoral shorter than the head, not extending to origin of anal. Brownish; fins pale; margin of anal and middle rays of caudal blackish.

Length, to base of caudal, 60 mm.

Several specimens from the Persian Gulf and the Mekran Coast.

PETROSCIRTES MEKRANENSIS.

Depth of body equal to length of head, $5\frac{1}{4}$ times in the length (without caudal). Snout not projecting beyond the mouth, which extends to below the middle of eye. Diameter of eye $\frac{1}{4}$ the length of head and greater than the interorbital width. Canine teeth strong, specially in the lower jaw. A well-developed triangular crest extending from between the eyes nearly to origin of dorsal (? in males only); no tentacles. Dorsal 32, highest posteriorly. Anal 23. Caudal rounded. Pectoral $\frac{5}{6}$, ventral $\frac{2}{3}$ the length of head. 6 pairs of dark vertical bars on sides of body, and posteriorly small white spots also; head with similar bars which are, however, irregular and somewhat oblique; occipital crest with dark vermiculations; dorsal anteriorly with dark median and marginal longitudinal lines; anal and pectoral with dark lower margin.

Length, to base of caudal, 49 mm.

A single specimen from Jask, Mekran Coast.

PETROSCIRTES TOWNSENDI (Pl. III, fig. 7).

Depth of body about $5\frac{1}{4}$ times in the length (without caudal), length of head $4\frac{2}{3}$ times. Snout projecting beyond the mouth, which is transverse, inferior, below anterior part of eye. Diameter of eye $\frac{1}{3}$ the length of head and equal to the interorbital width. No canines in the upper jaw, those of the lower jaw strong. Head without crest or tentacles. Dorsal 34, with the rays gradually decreasing in length in the latter half of the fin. Anal 22. Caudal emarginate. Pectoral $\frac{4}{5}$, ventral $\frac{1}{3}$ the length of head. Brownish, fins pale; anterior part of dorsal with a prominent black marginal stripe.

Length, to base of caudal, 31 mm.

A single specimen from Jask, Mekran Coast.

2. LIST OF DEEP-SEA FISHES FROM THE SEA OF OMAN.

1.	*Uroconger lepturus*, Richards	(140-205 faths.)
2.	*Scopelus pyrsobolus*, Alc.	(225 faths.)
3.	*Harpodon squamosus*. Alc	(170-243 faths.)
4.	*Champsodon vorax*, Gthr.	(-140 ,,)
5.	*Physiculus argyropastus*, Alc. ...	(107-205 ,,)
6.	*Epinephelus praeopercularis*, Blgr. ...	(-175 ,,)
7.	,, *undulosus*, Q. G.... ...	(-170 ,,)
8.	*Synagrops philippinensis*, Gthr. ...	(170 faths.)
9.	*Parascolopsis townsendi*, Blgr. ...	(140-225 faths.)
10.	*Gobius cometes*, Alc.	(180 faths.)
11.	*Laeops macrophthalmus*, Alc.	(180 ,,)
12.	*Cynoglossus carpenteri*, Alc.	(170-243 faths.)
13.	*Solea umbratilis*, Alc.	(98 faths.)
14.	*Tetraroge guentheri*, Blgr.	(142 ,,)
15.	*Minous inermis*, Alc.	(-180 faths.)
16.	* *Trigla arabica*, Blgr.	(-180 ,,)
17.	*Lepidotrigla omanensis*, Rgn.... ...	(180 faths.)
18.	*Callionymus carebares*, Alc.	(98-180 faths.)
19.	*Neobythites steaticus*, Alc.	(175 faths.)

3. LIST OF FISHES OF THE PERSIAN GULF.

1. *Amphisile strigata*, Gthr.
2. †*Psenes indicus*, Day.
3. *Epinephelus taurina*, Forsk.
4. ,, *argus*, Bl. Schn.
5. ,, *fuscoguttatus*, Forsk.
6. ,, *chlorostigma*, C. V.
7. ,, *merra*, Bl.
8. *Anthias townsendi*, Blgr.

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* *Trigla hemisticta* (non Schlegel) Day, Fishes of India, Suppl. p. 791 (1888), and Alcock. Cat. Ind. Deep-sea Fishes, p. 67 (1899).

† *Psenes indicus* is only doubtfully distinct from the Atlantic *Ps. regulus* (Poey). The latter has been figured by Goode & Bean (Oceanic Ichthyology, fig. 229) under the name *Ps. maculatus* (non Lutken). According to this figure the scales are more numerous in a vertical series than in *Ps. indicus* (compare Day's figure) but other differences are not evident.

9. *Anthias hypselosoma*, Blkr.
10. *Apogon quadrifasciatus*, Val.
11. ,, *bifasciatus*, Rüpp.
12. ,, *nigripinnis*, C. V.
13. *Mesoprion annularis*, C. V.
14. ,, *erythropterus*, Bl.
15. *Pagrus spinifer*, Forsk.
16. *Lethrinus striatus*, Stdr.
17. *Scolopsis ghanam*, Forsk.
18. *Pristipoma stridens*, Forsk.
19. *Diagramma pictum*, Thunb.
20. *Pseudochromis persicus*, Blgr.
21. ,, *nigrovittatus*, Blgr.
22. *Heniochus macrolepidotus*, L.
23. *Drepane punctata*, L.
24. *Teuthis nebulosa*, Q. G.
25. *Pomacentrus jerdoni*, Day.
26. ,, *obtusirostris*, Gthr.
27. *Glyphidodon sindensis*, Day.
28. ,, *cœlestinus*, C. V.
29. *Platyglossus hyrtelii*, Blkr.
30. ,, *roseus*, Day.
31. ,, *dussumieri*, C. V.
32. *Pseudoscarus jantochir*, Blkr.
33. *Scorpaena cirrhosa*, Thunb.
34. *Pterois russellii*, Benn.
35. *Scomber microlepidotus*, Rüpp.
36. *Gobius albopunctatus*, C. V.
37. ,, *ophthalmotœnia*, Blkr.
38. ,, *townsendi*, Blgr.
39. ,, *hoplopomus*, C. V.
40. *Eleotris diadematus*, Rüpp.
41. *Psettodes erumei*, Bl. Schn.
42. *Pseudorhombus arsius*, Ham. Buch.
43. *Synaptura zebra*, Bl.
44. *Percis nebulosa*, Q. G.
45. *Callionymus persicus*, Rgn.
46. *Blennius persicus*, Rgn.

47. *Salarias sindensis*, Day.
48. ,, *dussumieri*, C. V.
49. ,, *fasciatus*, Bl.
50. ,, *opercularis*, Murr.
51. ,, *anomalus*, Rgn.
52. *Petroscirtes barbatus*, Ptrs.
53. *Batrachus grunniens*, L.
54. *Antennarrius nummifer*, Cuv.
55. *Monacanthus oblongus*, Schleg.
56. ,, *tomentosus*, L.
57. *Ostracion cyanurus*, Rüpp.

4. FISHES FROM MUSCAT.

The following are not included in Steindachner's List of Fishes from the East Coast of Arabia :—

1. *Trygon walga*, Müll & Henle.
2. *Muræna pseudothyrsoidea*, Blkr.
3. *Pegasus natans*, L.
4. *Amphisile strigata*, Gthr.
5. *Epinephelus merra*, Bl.
6. *Cirrhitichthys calliurus*, Rgn.
7. *Apogon thurstoni*, Day.
8. ,, *holotænia*, Rgn.
9. *Genyoroge bengalensis*, Bl.
10. *Upeneus indicus*, Shaw.
11. *Equula rivulata*, Schleg.
12 *Platyglossus bimaculatus*, Rüpp.
13. *Duymæria flagellifera*, C. V.
14. *Scorpæna cirrhosa*. Thunb.
15. ,, *rosea*, Day.
16. *Minous inermis*, Alc.
17. *Apistus alatus*, C. V.
18. *Prosopodasys leucogaster*, Richards.
19. *Platycephalus subfasciatus*, Gthr.
20. ,, *nigripinnis*, Rgn.
21. ,, *townsendi*, Rgn.
22. ,, *maculipinna*, Rgn.
23. *Lepidotrigla bispinosa*, Stdr.

24. *Gobius andamanensis*, Day.
25. *Percis pulchella*, Schleg.
26. ,, *smithii*, Rgn.
27. *Trichonotus setigerus*, Bl. Schn.
28. *Callionymus filamentosus*, C. V.
29. ,, *persicus*, Rgn.
30. ,, *margaretæ*, Rgn.
31. ,, *muscatensis*, Rgn.
32. *Blennius semifasciatus*, Rüpp.
33. *Rhomboidichthys pantherinus*, Rüpp.
34. ,, *grandisquamis*, Schleg.
35. ,, *poecilurus*, Blkr.

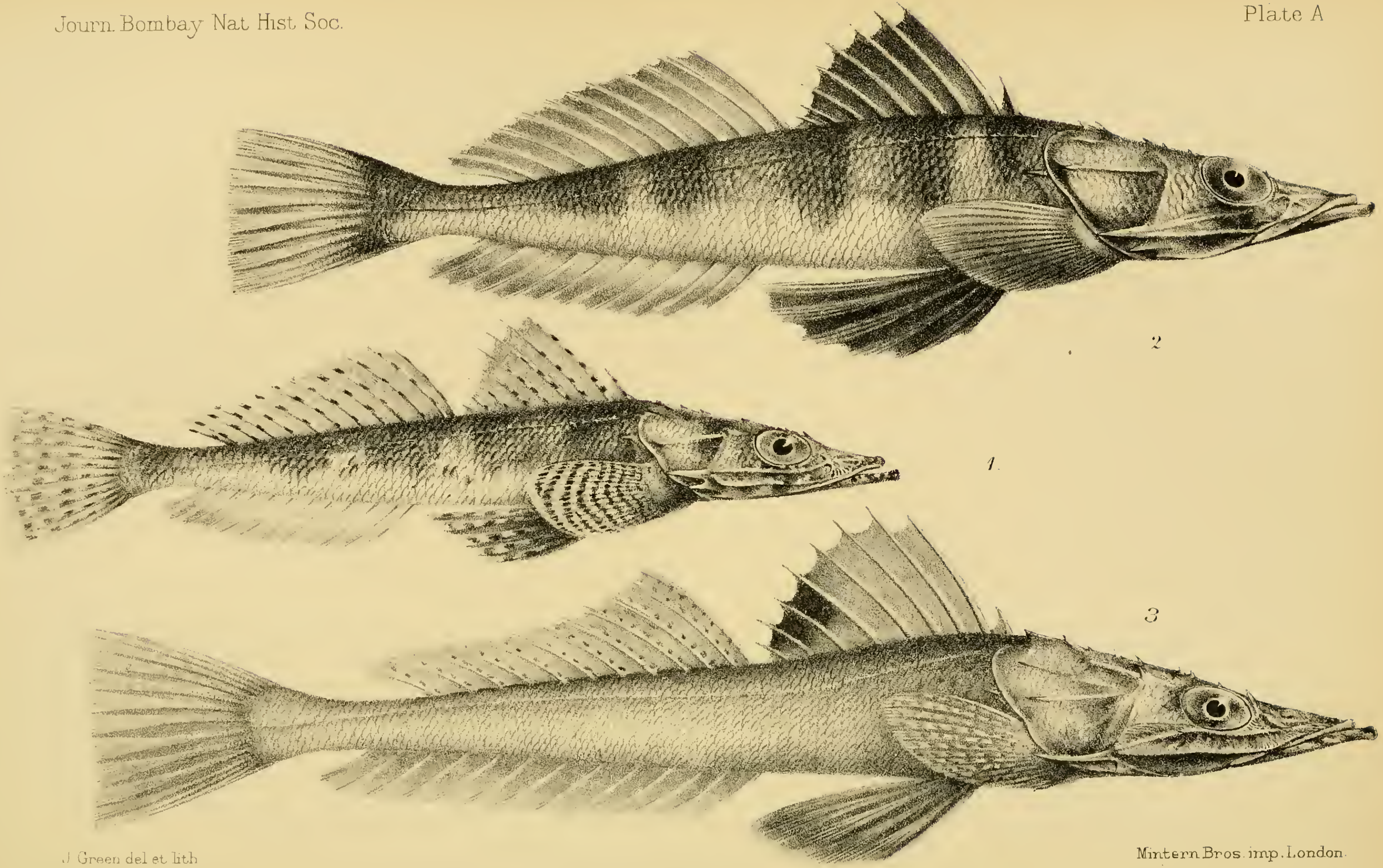
5. FISHES FROM THE MEKRAN COAST AND KARACHI.

A list of the Fishes collected by Mr. Townsend on the Mekran Coast is being published in the Imperial Baluchistan Gazetteer. In this. *Apogon fasciatus* (White), *Equula nuchalis* (Schleg.), and *Callionymus longicaudatus* (Schleg.) should be replaced by *Apogon melanotœnia* (Rgn.), *Equula daura* (Cuv.), and *Callionymus persicus* (Rgn.) respectively, and the following species should be added :—

Opisthognathus nigromarginatus, Rüpp.
Platyglossus dussumieri, C. V.
Minous monodactylus, Bl. Schn.
Gobius ornatus, Rüpp.
Eleotris diadematus, Rüpp.
Salarias anomalus, Rgn.
Petroscirtes punctatus, C. V.
,, *mekranensis*, Rgn.
,, *townsendi*, Rgn.

Karachi falls within the province treated of in Day's "Fishes of India," and the additions, except in the case of the new species described above. are unimportant.

Plate A



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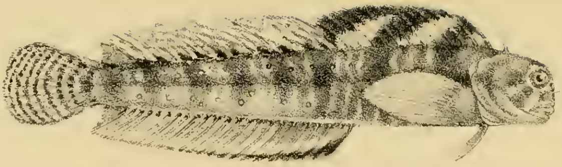
NEW FISHES COLLECTED BY M^r F. W TOWNSEND

1 Platycephalus townsendi.   2. P. nigripinnis.   3. P. maculipinna.



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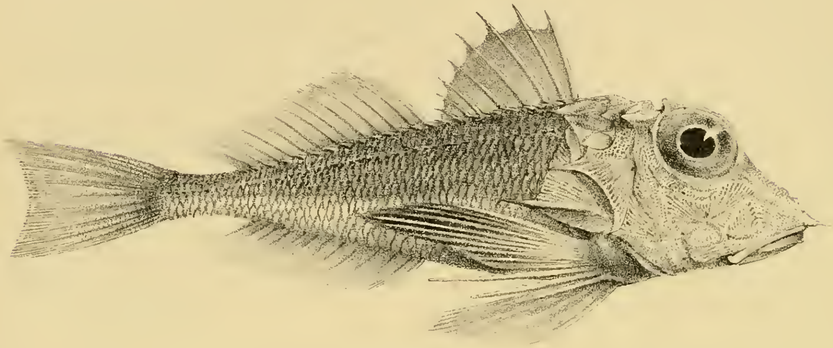

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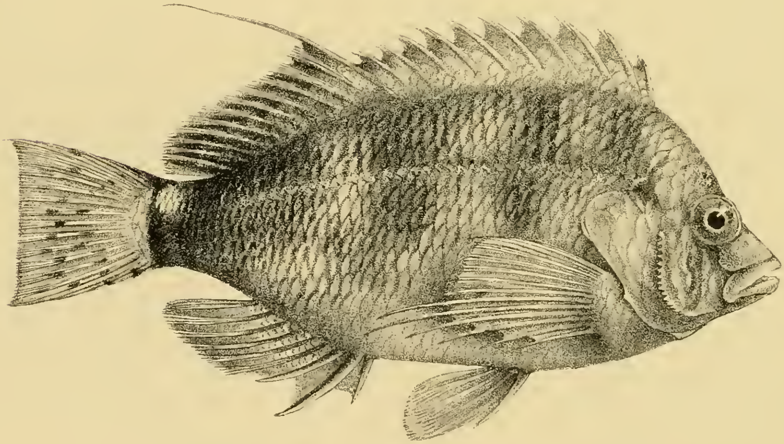

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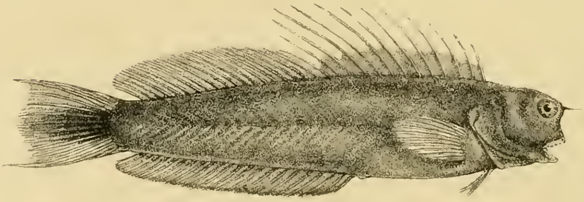

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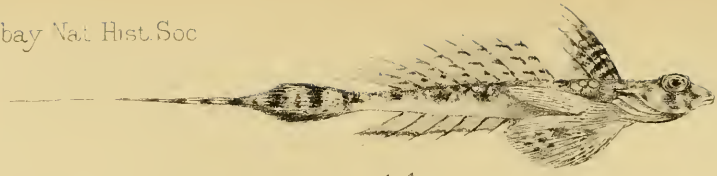
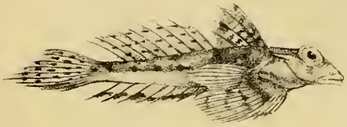
NEW FISHES COLLECTED BY M^{R} F. W. TOWNSEND.

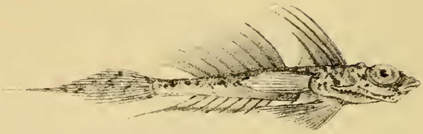
1. *Blennius persicus* 2. *Lepidotrigla omanensis*
3. *Cirrhitichthys callurus* 4 *Salarias anomalus*



1 ♂



1a ♀



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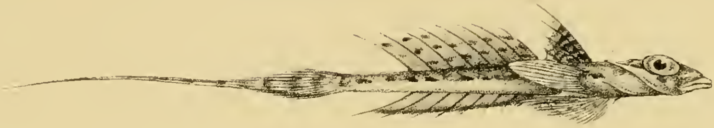

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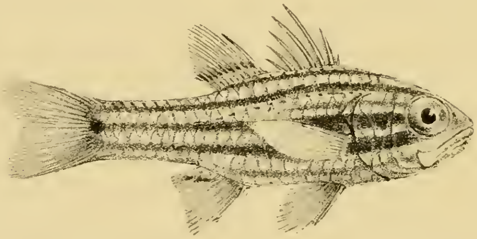

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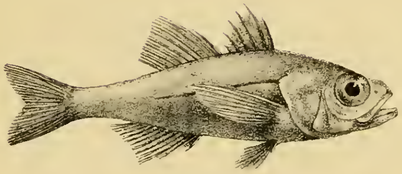

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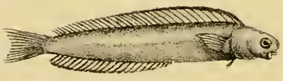

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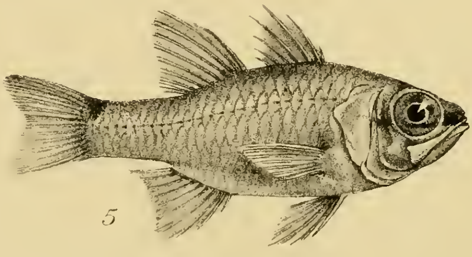

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NEW FISHES COLLECTED BY MR F. W. TOWNSEND.

1. 1A. Callionymus persicus. 2. C. muscatensis. 3. C. margaretæ.
4. Apogon melanotænia. 5. A. spilurus. 6. Apogonichthys nudus.
7. Petroscirtes townsendi.

EXPLANATION OF THE PLATES.

Plate A.

Fig. 1. Platycephalus townsendi.
,, 2. ,, nigripinnis.
,, 3. ,, maculipinna.

Plate B.

Fig. 1. Blennius persicus.
,, 2. Lepidotrigla omanensis.
,, 3. Cirrhitichthys calliurus.
,, 4. Salarias anomalus.

Plate C.

Fig. 1. Callionymus persicus, ♂ ; 1*a*, ♀
,, 2. ,, muscatensis.
,, 3. ,, margaretæ.
,, 4. Apogon melanotænia.
,, 5. ,, spilurus.
,, 6. Apogonichthys nudus.
,, 7. Petroscirtes townsendi.

THE FAUNA AND FLORA OF OUR METALLIC MONEY.

By E. Blatter, S.J.

(*Read before the Bombay Natural History Society on* 16*th March* 1905).

Some time ago, I was asked by a friend to examine some specimens of our current coins with a special view to plague bacilli. Fulfilling his wish I subjected a good number of pieces to careful examination. I detected a great variety of things belonging both to the animal and vegetable kingdom, as well as to the inorganic world. Though I did not succeed in satisfying my friend with these results, as I did not observe a single specimen of that plague-engendering organism, I nevertheless might interest some of the readers of this journal by a short determination of the plants and animals belonging to the flora and fauna of our metallic money.

I need not say that in this examination I made use of the common ways of sterilisation, of culture media, and the different methods of staining which are necessary for the exact study of the micro-organisms.

I began with scratching a small particle from the surface of a coin. Examining it in sterilized water with a low magnifying power I could not distinguish anything but a brown, dark, untransparent, shapeless mass, and some cylindrical bodies protruding on the surface of that conglomerate. I crumbled the object, and now the single pieces had changed colour entirely, looking yellowish and showing a granular structure. Using a power of 525 I could easily detect the nature of those elongated bodies. In this and the following cases small portions of hair were observed, and amongst these especially the roots were of frequent occurrence. This is quite natural, as the root of each hair is lodged in the follicle which descends into the subcutaneous fat, and is thus surrounded by a more sticky substance than the shaft. Sometimes intimately connected with the hair follicles, sebaceous glands were observed. As the hairs taken from the different parts of the body all show certain characteristic peculiarities, it was not difficult to trace the origin of the various particles. In this way I detected hairs which are found on the head, on the arm, in the arm-pit, in the nose, on the eye-brow. With a higher power I could even distinguish single cortical scales which cover the long fibrillated cells of the hair. A power of 1,000 disclosed the presence of parasitic fungi and of a mite, called *Demodex folliculorum hominis*, which seems to choose the hair follicles and sebaceous glands of man as a favourite haunt. Of silk, cotton, and wool, I saw threads of sometimes considerable length.

This was all I could detect without further preparations. For a better examination of the rest I dissolved some scrapings in a watch-glass of lukewarm sterilized water. After two hours the apparently homogeneous substance was divided into a layer of fine sediment on the bottom of the vessel, into free-moving particles, and a greyish layer on the surface of the water. When I repeated this experiment and always examined one portion after the other, the microscope showed the following details. Floating on the surface there were bodies of chiefly vegetable origin: stellate hairs of a plant belonging to the order of Solanaceæ, glandular hairs of one of the Labiatæ, sporangia without spores of a fern belonging to the Polypodiaceæ, small particles of wood of a dicotyledoneous stem, a tangential-longitudinal section of the stem of a grass, macerated to such an extent as to be wholly transparent.

The greatest portion of the surface material consisted of exceedingly small particles of mostly organic origin, which were obviously in a state of decomposition and did not give, therefore, any possibility of identification.

When I examined drop after drop, many of them disclosed microscopical organisms of various colour, shape, and size. A strong magnifying power showed globular cells, mostly isolated, but sometimes united into small groups. The bright green contents of the cells, the presence of chromatophores, the small starch grains in the chromatophores, which were visible in an iodine solution, of the size of 2—6 μ, and finally the comparison with the organism which I suspected to be the same and which I had found on the outer surface of a flower-pot, made it sure that the object in question was *Pleurococcus vulgaris*, Menegh. In the same way I found another alga, a species of Nitzschia Hassal, which belongs to the diatoms. The chromatophores were completely reduced, wherefore it was one of the diatoms which assume a saprophytic mode of life. Its size was 50—60 μ in length. In another case the field of view showed small globular and elliptic cells, 6 μ in length. Within a delicate membrane several small vacuoles, sometimes a large one, could be recognized. A culture in Pasteur's fluid enabled me to observe multiplication by budding. From the circumstance that gemmation is peculiar to the saccharomycetes and from other microscopical characters obtained by hardening and staining

I came to the conclusion that the plant was *Saccharomyces ellipscoideus,* Rees, or wine yeast. Another species of the same genus, *Saccharomyces mycoderma,* Rees, exhibited elliptical and cylindrical cells of 5—7 μ, in length. It is the plant which forms a thin membrane on the surface of already fermented liquids without causing fermentation itself, *v.g.* in half-empty bottles of wine.

May I be allowed now to enumerate in a shorter way what else the microscope revealed to the observing eye.

Of the organisms belonging to the Schizomycetes or Bacteria, the following were examined :—

MICROCOCCUS UREÆ, Cohn.—Diameter of cells 1·1—2 μ ; 2—8 individuals were united into chains. It is the cause of fermentation of the urine, splitting up urea into ammonium carbonate.

MICROCOCCUS CREPUSCULUM, Cohn.—Cells short, oval. Diameter 2 μ. It is found in various infusions. In company with MICROCOCCUS CREPUSCULUM I found Bacterium termo, Ehrl. Length 1—3 μ. Twice or three times as long as broad, cylindric or elliptic, usually in pairs. It is the ferment of putrefaction of liquids.

VIBRIO RUGULA, Mull.—Length 6—17 μ. Is found in ponds, rainwater, and also in fæces.

BEGGIATOA ROSEO-PERSICINA, Zopf.—Pinkish or violet. Found on fresh and salt water in places where vegetable and animal bodies putrefy. They give the water the blood-red colour.

CLOSTRYDIUM BUTYRICUM, Prazm.—In the presence of this bacterium butyric acid is formed from various carbohydrates. The rod-like cells measure in length 2—2·5 μ, in breadth 1 μ.

BACTERIUM ACETI, Zopf, the acetic acid bacteria which oxidise alcohol to acetic acid.

STAPHYLOCOCCUS PYOGENES.—It is a spherical coccus 0·9 μ in diameter, found irregularly in masses or clusters. It is one of the bacteria which cause suppuration. I was not able to identify the exact variety.

BACILLUS TUBERCULOSIS, Koch.—The tubercle bacillus varies very much in size. I found some of 2·6—3·4 μ in length, and others of 4 μ.

DIDYMIUM SCHRAD.—As I found it only as plasmodium and without sporongia and spores, I could not make sure of the specific characters. Of the Zygomycetes there were only two species.

Mucor stolonifer, Ehrh. It forms white growths on various substances, especially on putrefying vegetable bodies.

Chætocladium, Fres. It is a parasite on *Mucor stolonifer*, Ehrh., found on animal excreta. The fungus showed sexual spores (Conidia).

There was only one of the Haplomycetes, a species of *Torula Pers.* Identification was impossible, as I observed only spores without myceliums. The torulas form dust-like coats on various bodies, usually on dead and sometimes on still living bodies.

The animal kingdom offered only few representatives.

Amæba terricola Greef.—Diameter of the whole body 350—400 μ. I found it dead in the state of encystation.

There were some 2 or 3 species of infusorians, but for want of a sufficient number of specimens, determination was impossible.

Of rarer occurrence were red blood corpuscles, fat cells of adipose tissue, small portions of the epidermis of human skin, pus cells and even eggs of insects.

Very frequent were starch-grains of different plants :

Starch-grains of potato.—By them the light is reflected to differing degrees. Their hilum is not the geometrical centre, but lies nearer to one end. Length 60—100 μ.

Starch-grains of wheat ; they are circular, their lamination regular, their diameter 35—40 μ.

Starch-grains of rice ; they are very small, polyhedral ; compound grains of great beauty are met with. Diameter 6—7 μ.

Starch-grains of West Indian arrowroot. The lamination is less clear, but more uniform than in potato starch. A cleft in the form of a V characterises the starch of arrowroot.

Also white and black pepper was found. The only difference between the two kinds of pepper is, that in the white there are no particles of the exocarp and no parenchyma of the seed-vessel.

Cinnamon-powder, which was observed, is distinguished by the following elements. Thin spindle-like bast fibres, circa 50 μ in length ; thick-walled cells of the bast parenchyma, containing starch, slerenchyma with or without starch, oil-glands, crystals of calcium-oxalate from the cells of the medullary rays.

The greatest part of all the matter detected on money, and found as the chief constitutent part of the sedimentary layer, was dust, *viz.* microscopic and ultramicroscopic bodies of inorganic origin. Of only a small number of minerals the crystallographic characters could be recognized by means of the polarising miscroscope and by the application of re-agents, *v. g.* of silica, calcium carbonate, etc.

Besides the bacteria above enumerated I could trace the presence of some two or three others. But as they were only few in number, and fresh and good food supply did not induce them to multiply, a definite identification was, of course, beyond the bounds of possibility.

That there may not arise any misapprehension in the reader's mind, I must not omit saying that not all of the above mentioned forms of organisms were found on each and every coin, but that, on the contrary, there was amongst the examined pieces a pretty good number which did not exhibit the actual presence of life at all.

If we bear in mind, where nearly all of those micro-organisms usually or, to use a more correct expression, exclusively occur, we cannot help confessing, that they are associated with the presence of decaying matter. And again if we consider, through what hands and pockets a coin may travel in the course of one single day, we shall not have the least difficulty in understanding how the fauna and flora of our money came into existence.

When I had already finished this paper my attention was drawn upon two letters addressed to the Editor of the *Times of India*. On the 10th February 1905 the Baroda correspondent, Dr. R. V. Dhurandhar, writes the following lines :—

" Will not the Government of India think twice before extinguishing copper coins and substituting bronze and nickel ones in their place, in the face of modern research in that direction ? The Health Board of New York some time back undertook an investigation to ascertain how far gold, silver, copper, and paper currencies assist in the transmission of disease germs from place to place, and they found on miscroscopic examination that, while other currencies swarmed with germs, none were found on copper coins."

Further on he adds: " Bronze though coppery, contains tin, and sometimes lead and zinc, and, therefore, is not as good a germicide as pure copper."

The second letter (11th February 1905), written by Mr. S. G. D'Souza, contains these remarks : " In common with Mr. Dhurandhar I quite agree that copper, far from transmitting disease germs, is a most potent agent of prevention of the same.—In those days when cholera regularly made its dreadful ravages in Bombay every third year, the coppersmiths were to a man immune from it. I, therefore, think the substitution of bronze and nickel coins for copper ones undesirable."

These two letters afford me the welcome opportunity of expressing my full agreement with the views advanced in them. Dr. Dhurandhar, however, says, that " while other currencies swarmed with germs none were found on copper coins." If I, as regards our metallic money, said the same, the statement would surely not agree with the facts, as the above mentioned organisms were seen not only on silver-coins but also on copper-currencies. The only difference was that the plants and animals detected on copper were devoid of life, while those on silver-coins, in most cases, were animated. And so we may say with Dr. Dhurandhar, that copper is an excellent germicide.

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SUPPLEMENTARY NOTES ON THE *COCCIDÆ* OF CEYLON.

By E. Ernest Green, F. E. S.,
Entomologist to the Government of Ceylon.

Part III.

(*With Plates H—K.*)

Since the earlier appearance of my "Supplementary Notes" in this Journal (Vol. XIII, Nos. 1 and 2), a fresh mass of material has been accumulated, necessitating a further series descriptive of new species of *Dispidinæ* from Ceylon. Nor can it be supposed that the supply is yet exhausted, although the original number of species recorded in my monograph has now been more than doubled. Large areas of the Island still remain unexplored (as regards *Coccidæ*) and new species are frequently discovered even in the best worked localities, as may be seen from the frequency with which the name "Peradeniya" appears in the following pages.

Genus ASPIDIOTUS.

Aspidiotus longispinus, Morgan. (Pl. H, fig. 1.)

Aspidiotus longispina, Morg., Ent. Mo. Mag., XXV., p. 352.

Morganella longispinus, Ckll., Bull. 6, Dep. Agric. (1897).

Hemiberlesia longispinus, Leon., Riv. Pat. Veg., vi. (1897).

Morganella maskelli, Ckll., Bull. 6, Dep. Agric., p. 22 (1897).

♀ Puparium black, circular, moderately convex, dense and usually more or less obscured by fragments of bark. Diameter 1·10 mm.

♂ Puparium not observed.

Adult ♀ subcircular, the pygidium only slightly projecting beyond the general curve. Colour whitish; the chitinous parts stained a deep brown. Pygidium (fig. 1) with two rather narrow prominent convergent median lobes almost or quite contiguous. Margin on each side fringed with numerous narrow elongate squames, some of them deeply fimbriate, others obscurely so. Spines deep black, stout, long and whip-like, projecting far beyond the squames. No circumgenital glands. In all my examples the terminal half of the pygidium is densely chitinous and deep coloured, obscuring all pores and other characters. Diameter 0·50 to 1 mm.

Adult ♂ unknown.

Habitat.—In Ceylon, beneath loose bark on stems of the "Jak" tree (*Artocarpus integrifolia*). The scales are frequently embedded in the loose tissues of the cortex. (Peradeniya.)

Aspidiotus cuculus, n. sp. (Pl. H, figs. 2, 3.)

♀ Puparium very irregular in form, due to the fact that it has to accommodate itself to the cavity which it inhabits. This cavity is of a conical shape and may contain as many as five of the insects, the puparia being then crowded and pressed together, elongated in the direction of the duct of the gall. Colour dull brown, usually comprising portions of the pellicle and derm of the former occupant. It is difficult to isolate a single individual for purposes of measurement, but the united mass has a length of about 2 mm.

♂ Puparium not observed.

Adult ♀ (fig. 2) white or pale yellow. Long pyriform. Pygidium terminating in two stout obscurely emarginate lobes; the margin for a short distance beyond them thickened and irregular (fig. 3). Two groups of about six long stout spiniform squames on each side of lobes, divided by a small marginal prominence. A larger conical point immediately beyond the outer group. Anal orifice small. Dorsal pores very minute and inconspicuous. No circumgenital or parastigmatic glands. Length 1 to 1·25 mm. Breadth 9·75 to 9·85 mm.

Adult ♂ not observed.

Habitat.—Female insects occupying the galls of another Coccid (*Amorphococcus mesuæ*), after that insect has died, whether on account of the intrusion or from natural causes, I have as yet been unable to determine.

Aspidiotus (Chrysomphalus) pedronis, n. sp. (Pl. H, fig 4.)

Puparium clear brownish straw-colour; pellicles paler, circular, flattish. Diameter 2·50 mm.

♂ Puparium not observed.

Adult ♀ broadly pyriform. Pygidium (fig. 4) with six prominent floriate lobes approximately equal in size. Interlobular squames narrow, deeply fimbriate, of same length as lobes. Three broad aciculate serrate squames beyond the outer lobe on each side. Circumgenital glands in five groups; median group with 1 or 2 pores; upper laterals 5 to 6; lower laterals about 6. Dorsal pores oval, moderately large and conspicuous, communicating with long trumpet-shaped ducts. Length 1·59 mm.

Adult ♂ not known.

Habitat.—On leaves of undetermined tree. Pedrotalagalla, at an elevation of about 8,000 feet. April.

Differs from *A. dictyospermi* in having the lobes of more equal size and in the much smaller and more ill-defined paraphyses.

ASPIDIOTUS (CHRYSOMPHALUS) MALLEOLUS, n. sp. (Pl. H, figs. 5, 6.)

♀ Puparium opaque snowy white ; dense, broad and flat ; irregularly deltoid. Pellicles pale straw-colour, usually marginal. Long diameter 4·50 to 5·50 mm.

♂ Puparium similar but very much smaller. Length 2·25 mm.

Adult ♀ (fig. 5) rather densely chitinous, elongate ; cephalothoracic segment broadest, with a deep constriction behind ; mesothoracic segment narrowest ; segments well-defined, but margins not produced. Pygidium (fig. 6) with eight rather small but stout rounded lobes, their outer edges obscurely emarginate. Squames rather small but projecting beyond the lobes, not conspicuously fimbriate. Six large conspicuous clavate paraphyses and many smaller ones. Circumgenital glands numerous, in two curved groups. Median dorsal area of pygidium conspicuously reticulate (as in *A. trilobitiformis* and its allies). Length 1·75 to 2·25 mm.

Habitat.—On under surface of leaves of *Mimusops hexandra.* Elephant pass, N. P. March.

The specific name has been suggested by the hammer-like form of adult female.

ASPIDIOTUS (CHRYSOMPHALUS) CISTULOIDES. n. sp. (Pl. 1, figs. 7, 8).

♀ Puparium (fig. 7) dull blackish-brown ; broadly oval, somewhat pointed behind ; the ventral scale dense and strongly developed, the hinder portion steeply up-tilted and projecting beyond the margin of the dorsal scale. Dorsal scale rather strongly convex ; subconical ; the pellicles placed on the summit, nearer the anterior extremity. Larval pellicle only exposed, reddish. Length 1·35 mm. Breadth about 1 mm.

♂ Puparium of same colour, but flattened, smaller and more elongate. Length 1·25 mm. Greatest breadth 0·75 mm.

Adult ♀ turbinate ; a deep constriction separating the pro- and mesothorax and a less-marked constriction behind the meta-thorax. Derm rather densely chitinous. Margin of pygidium (fig. 8) strongly cristate. There are six lobes, with difficulty distinguishable from the other marginal prominences. Median pair bluntly conical, with slightly emarginate sides. Second and third pairs sharply conical, each with a denticle on outer margin. Second pair smallest ; third pair largest.

Beyond the third lobe the margin is broken into strongly serrate prominences. Squames and spines small and inconspicuous. Four moderately developed elongate paraphyses on each side, and numerous smaller ones between them. Anal orifice small, elongate, distant from margin about three times its own length. Circumgenital glands consisting of a single small group (of from 2 to 4 orifices) on each side, and two or three isolated orifices between them forming a broken median group. Dorsal pores minute and inconspicuous. Length 1 to 1·10 mm.

Adult ♂ not observed.

Habitat.—Occurring sparsely on leaves of *Cinnamomum.* Peradeniya. January.

The peculiar form of the female puparium gives it the appearance of a small capsule resting on the leaf. In this particular it closely resembles a species from Java, on *Piper nigrum* (to be described later under the name of *A. capsulatus.*)

ASPIDIOTUS (CHRYSOMPHALUS) QUADRICLAVATUS, n. sp. (Pl. I, fig. 9.)

♀ Puparium flat, subcircular, very dark chocolate-brown. Larval pellicle exposed, prominent, of same colour as the secretionary area. Nymphal pellicle completely concealed. Diameter 3 mm.

♂ Puparium similar in colour and texture to that of ♀, but smaller and oblong. Length 2 mm. Breadth about 1 mm.

Adult ♀ dull pale purplish. Pygidium (fig. 9) with eight stout bluntly pointed lobes, their sides slightly emarginate: the second pair somewhat smaller than the others and situated close to the median lobes. Margin beyond the lobes thickened and cristate. There are four very large and conspicuous clubbed paraphyses and two smaller and simple—exterior to the others. Squames small and obscure. Dorsal pores small and inconspicuous. Circumgenital glands presumably in five groups, but forming together an almost continuous arch, difficult to separate into its component parts, narrowest in the middle and thickening at the extremities. Orifices numerous—75 to 100. Anal aperture minute. Greater diameter (longitudinal) 1·25 to 1·75 mm.

Adult ♂ not observed.

Habitat.—On upper surface of leaves of *Murraya exotica.* Peradeniya. July.

Both ♂ and ♀ puparia are very firmly attached to the leaf. It is difficult to remove them entire.

The puparia are scarcely distinguishable from those of *A. rossi*, but the exceptionally large paraphyses and the disposition of the circumgenital glands distinguish it from that or any other species of *Chrysomphalus.*

ASPIDIOTUS (AONIDIELLA) TAPROBANUS, n. sp. (Pl. I, fig. 10).

♀ Puparium pale, transparent, straw-colour : pellicles slightly darker. Flattish ; irregularly oval. Ventral scale thin and delicate, adhering to under surface of dorsal scale in such a manner as to leave a central channel. Greatest diameter 2 to 2·25 mm.

♂ Puparium smaller and paler : more elongate. Length 1·50 mm.

Adult ♀ yellow. Pyriform. Pygidium (fig. 10) with six prominent rounded floriate lobes of equal size. Squames broad and deeply fimbriate : the outermost three aciculate. Paraphyses small and inconspicuous, one at inner side of base of each lobe. No circumgenital glands. Pygidial characters very similar to those of *A. aurantii*, but ultra-lobular squames not bifid. Length 1 to 1·25 mm. Breadth about 0·75 mm.

Adult ♂ not observed.

Habitat.—On leaves of *Phyllanthus myrtifolius* : usually on upper surface. Peradeniya. May.

The species differs from *aurantii* in the simple form of the ultra-lobular squames. The derm is more delicate and never becomes densely chitinous : nor are the pygidium and abdominal parts withdrawn into the body as in *aurantii.*

ASPIDIOTUS (TARGIONIA) PHYLLANTHI, n. sp. (Pl. I, fig. 11).

♀ Puparium dull black, with a raised whitish disc on larval pellicle : moderately convex : more or less concealed beneath the corky outer bark. Diameter 1 to 1·25 mm.

♂ Puparium grayish, (a whitish bloom overlying the blackish secretionary area). Pellicle very dark shining brown, with a raised whitish circle in centre. Length 1 mm.

Adult ♀ circular : the pygidium only slightly projecting, demarked from abdomen by a curved series of irregular thickened chitinous patches. No parastigmatic or circumgenital glands. Pygidium (fig. 11) with eight well-defined stout emarginate lobes, each with a conspicuous elongate paraphysis at its base. No pectinate squames. Dorsal pores small, circular. Diameter 0·60 to 0·70 mm.

Adult ♂ brownish orange : notal plates and scutellum paler : apodema castaneous. Form broad, depressed. Head small : ocelli black :

rudimentary eyes colourless, inconspicuous. Terminal joint of antenna with one knobbed hair at apex and two at side. Foot with four knobbed hairs. Wings ample, hyaline, slightly iridescent. Genital sheath very long and narrow, as long as or longer than abdomen: sharply pointed. Total length 0·75 mm.

Habitat.—On *Phyllanthus myrtifolius.* Peradeniya. February. Female insects on stems and twigs, more or less concealed beneath the outer layers of the bark. Male insects on both surfaces of the leaves.

The pygidial characters approach those of *A. tenebricosus,* Comstock, but differ in the form, number and arrangement of the paraphyses and in the absence of pectinate squames.

ASPIDIOTUS (CRYPTOPHYLLASPIS) OCCULTUS, var. ELONGATUS, n. var.

(Pl. I, figs. 12,13).

Aspidiotus occultus, Green, Cocc. Ceylon, pt. 1, p. 56.

Cryptophyllaspis occultus, Ckll., Check List, Suppl., p. 396.

♀ Puparium consisting principally of a delicate film lining the cavity of the gall, the pellicles forming an operculum at its base.

The gall itself (fig. 12) is irregularly cylindrical, constricted towards the base, the ends often studded with irregular tubercles. Length of gall about 2 mm.

♂ Puparium not observed; but probably occupying shallow depressions on the surface of the leaf as in the type.

Adult ♀ elongate oval, abruptly constricted towards the base of the pygidium. Pygidium (fig. 13) with 6 prominent lobes. Median pair large and deeply coloured: others smaller and pointed. Squames extending beyond the lobes: stout, deeply fimbriate and furcate. Anal aperture elongate, narrow. No circumgenital glands. Length 1 mm. Greatest breadth 0·50 mm.

Adult ♂ not known.

The galls are massed on the under surface of leaves of *Grewia* sp.; the aperture opening on to the upper surface. Heneratgoda. Feb.

Differs from type in its elongate form and greater size: in the cylindrical (instead of globular) form of the gall: and in the position of the galls on under (instead of upper) surface of the leaf.

ASPIDIOTUS (CHRYSOMPHALUS) DICTYOSPERMI, Morg.

Ceylon examples are all of the variety *pinnulifera* (Mask.).

In addition to other food-plants mentioned, it occurs on *Opuntia cochinellifera.* (Peradeniya. February.) The puparia on this plant are almost white.

ASPIDIOTUS TRILOBITIFORMIS, Green.

Occurs also on *Ixora coccinia.* (Peradeniya. February.)

ODONASPIS PENICILLATA. n. s.p. (Pl. I, figs. 14 to 16.)

♀ Puparium (fig. 14) very pale fulvous: pellicles orange, usually concealed beneath the whitish secretion, situate at anterior extremity. Very firm and compact, the ventral scale as dense as the dorsal; the two scales so firmly adherent that it is difficult to extract the insect uninjured. Elongate: broadest immediately behind the pellicles: tapering posteriorly: flattened beneath: strongly convex in front, depressed towards hinder extremity. Length 1·50 to 2 mm. Greatest breadth 1 to 1·10 mm.

♂ Puparium (fig. 15) similar; but smaller, narrower and paler. Length 1 mm.

Adult ♀ clear pale purplish: oval. Pygidium (fig. 16) bluntly pointed: somewhat resembling that of *O. inusitatus*, but with a strongly cristate margin, three of the points on each side being larger and more prominent (possibly representing lobes). There is a moderately broad and deep excision at the extremity from which springs a dense brush of tapering hairs, the tips meeting in a point like a small paint-brush. No circumgenital glands. Numerous minute circular pores in the denser chitinous area. Six stout and moderately long paraphyses. Anal aperture near base of pygidium. Length 0·75 to 1·10 mm.

Adult ♂ very pale purplish pink: ocelli black. Legs, notal plates and genital sheath stained with reddish-yellow. Body rather slender: not depressed as in typical *Aspidiotus.* Abdomen without lateral flanges. Wings long and rather narrow. Genital sheath long and slender. Antenna 10-jointed: terminal joint with one knobbed hair at apex and two at side. First pair of feet with 4 digitules: second and third pairs with two only (1 on claw and 2 on tarsus). Total length 1 mm., of which the genital sheath occupies nearly one-third.

Puparia crowded on stems of a large Bamboo (*Gigantochloa aspera*), half embedded amongst the tomentose hairs around the nodes: attached by anterior extremity only. Peradeniya. May.

Allied to *O. inusitatus*, but easily distinguished by the termina pencil of hairs and more cristate margin of pygidium.

(Note. It is probable that my *Chionaspis simplex* (Cocc. Ceyt. Part II, p. 160, Pl. LVII) is more nearly allied to this group, in spite of its elongate form. The pygidial characters agree more with those of the genus *Odonaspis* than with *Chionaspis*.)

AONIDIA ECHINATA, n. sp. (Pl. J, figs. 17 to 19.)

♀ Puparium (fig. 17) dull reddish-brown (yellowish when immature), roughened with innumerable slender curved spines which are firmly attached to the nymphal pellicle and persist after treatment with caustic-potash. Circular; strongly convex. Larval pellicle deciduous,—pushed off during growth of nymphal pellicle. Diameter 0·35 mm.

♂ Puparium pale-yellowish. Oblong oval: secretionary area flattish: pellicle strongly convex, situate at anterior extremity. Length 0·75 mm.

Adult ♀ (fig. 18) subcircular. Rostral apparatus very large and conspicuous. No parastigmatic glands. Pygidium (fig. 19) with six excurved thorn-like processes (? lobes). Diameter about 0·30 mm.

Adult ♂ not observed.

On *Hemicyclia sepiaria*. Anaradhapura. February.

The insects are thickly clustered on the under-surface of the leaves and are surrounded by a whitish bloom such as is noticeable around some species of *Fiorinia* and many *Aleurodidæ*.

AONIDIA PUSILLA n. sp. (Pl. J, figs. 20, 21 %).

♀ Puparium (fig. 20) oval; yellow; obscured—in very fresh examples—by a thin covering of whitish secretion which, in older examples, persists only as a marginal fringe, leaving the yellow nymphal pellicle exposed. Larval pellicle deciduous. Nymphal pellicle with median area strongly convex and globose: cephalic area flattened and anteriorly produced: pygidial area similarly produced backwards and apparently articulated with the body of the scale to form a hinged operculum beneath which the young larvæ escape: margin of pygidium with ten narrow prominent lobes, and broad semilunar pores between them. Total length 0·50 mm.

♂ Puparium oval; somewhat larger, but much less convex: pellicle pale-yellow, occupying anterior two-thirds of puparium: secretionary area whitish, translucent. Length 0·65 mm.

Adult ♀ broadly oval: pygidial area very slightly prominent. No parastigmatic or circumgenital glands. Margin of pygidium (fig. 21) with two small conical lobes, one on each side of a median clavate prominence which projects beyond them: margin immediately outside the lobes also projecting in three or four small rounded prominences. Some scattered circular pores. Anal orifice large and conspicuous. Length about 0·30 mm.

Adult ♂ not observed.

On upper surface of leaves of *Carissa spinarum.* Elephant Pass, Northern Province. March.

In the characters of the female puparium, this species approaches *Aonidia bullata.*

AONIDIA CRENULATA, Green.

Taken also at Elephant Pass, N. P., on *Memecylon.* In these example the number of floriate processes is not constant, sometimes amounting to a total of 30. A few delicate filiform ducts open on the margin. In one example a single conical lobe appears asymmetrically on one side.

AONIDIA PLANCHONIOIDES, Green.

Adult ♂ pale yellow: apodema reddish. Body flattish and broad,—especially at point of attachment of wings.

AONIDIA SPATULATA, Green. (Pl. J, fig. 22.)

Adult ♂ very pale violaceous: notal plates pale ochreous. Form broad, depressed. Genæ very prominent, lobulate. Foot with 4 digitules. Terminal joint of antenna (fig. 22) with knobbed hair at apex and a similar one on the side. Wings broadly rounded.

AONIDIA MESUÆ, Green. (Pl. J, fig. 23.)

Adult ♂ (fig. 23) almost circular in outline. Lateral margin of abdomen dilated. Colour creamy white: thoracic plates outlined with brownish-purple. Antennæ violaceous. Legs pale fulvous.

GYMNASPIS SPINOMARGINATA, n. sp. (Pl. J, figs. 24, 25.)

♀ Puparium bright yellow; smooth and polished; minute; circular very strongly convex (more than hemispherical): consisting of the inflated nymphal pellicle with or without an inconspicuous secretionary extension. Larval pellicle deciduous. Diameter about 0·30 mm.

♂ Puparium not observed.

Adult ♀ (fig. 24) yellow: oval: strongly convex: divisions of segments very indistinct: margin closely set with tuberculate tubular spines connected with filiform ducts. Mouth-parts very large. Pygidium (fig. 25) with four narrow prominent lobes, each with a sharp tooth-like prominence on outer and inner edges. Compound spiniform squames (?) between and beyond the lobes. A submarginal series of broad semilunar pores—as in *Parlatoria.* No circumgenital or parastigmatic glands. Length about 0·25 mm.

Adult ♂ not known.

A minute and obscure species, occurring in small groups on undersurface of leaves of *Mesua ferrea*. Peradeniya. February.

Placed provisionally in the genus *Syngenaspis*: but possibly requiring a new genus for its reception. The general characters of the pygidium are suggestive of *Parlatoria* from which it differs in the absence of circumgenital glands. The remarkable marginal of tubular spines appear to be homologous with those found in some species of *Fiorinia*.

PARLATORIA PROTEUS, Curtis. (Pl. J, fig. 26.)

Aspidiotus proteus, Curtis. Gard. Chron., p. 676, (1843).

Diaspis parlatoris, Targ. Studii sul Cocc., p. 14, (1867).

Parlatoria proteus, Sign. Ann. Soc. Ent. Fr., (4), ix, p. 450, (1869). (Sign. Essai sur les Cochen., p. 132.)

♀ Puparium broadly oval: flattish. Brownish-ochreous: opaque or semidiaphanous. Pellicles overlapping; situated at anterior extremity; occupying about half the expanse of the puparium. Length 1·50 mm.

♂ Puparium narrow, elongate. Pellicle yellow, with broad blackish or greenish median fascia. Secretionary area pale ochreous. Length 1 mm.

Adult ♀ pale pinkish-purple. Broadly oval before gestation: shrinking after oviposition, until the breadth often exceeds the length. Pygidium broadly rounded: margin (fig. 26) with six prominent, conical, slightly floriate lobes. Squames broad and deeply fimbriate, extending along margin of abdominal segments. Broad conspicuous lunate pores in the interspaces between the lobes and at close intervals along the margin beyond. Circumgenital glands in four groups with few orifices—5 to 7 in each group, upper group usually with the larger number. Length 0·50 to 0·75 mm.

Adult ♂ not observed.

On upper surface of leaves of an orchid (*Cymbidium bicolor*). Kandy. December. Also on both surfaces of a cultivated orchid at Watagoda. Examples on the undersurface (which in this plant is the more exposed) have the puparium darker and more opaque, whilst those on the other surface are semi-transparent and paler.

The species is almost universally distributed, being recorded from nearly every part of the world. In temperate regions it is found only upon plants under glass.

PARLATORIA PERGANDII, Comst., var. MYTILASPIFORMIS, Green.

Parlatoria pergandii, Comstock, Rep. U. S. Dep. Ag. 1880, p. 327.

Parlatoria mytilaspiformis, Green, Cocc. Ceyl., pt. ii, p. 164.

I now agree with Dr. Leonardi that this insect is merely an extremely elongate form of *pergandii*—a species which differs from *P. proteus* principally in the possession of a small sharply conical fourth lobe on each side of the pygidium, separated from the third lobe by three fimbriate squames. This fourth lobe is replaced—in *proteus*—by a fimbriate process.

In var. *mytilaspiformis*, the fourth lobe is minute and inconspicuous. In typical *pergandii* it is somewhat larger.

PARLATORIA PERGANDII, var. PHYLLANTHI, n. var. (Pl. J, fig. 27).

Differs from type in the coloration of the ♀ puparium (fig. 27), the secretionary area of which is pale transparent ochreous, and the pellicles bright castaneous or brownish orange, each with a broad black median fascia. Length 1·50 mm.

♂ Puparium with the fascia on pellicle greenish. Length 1 mm.

Adult ♀ broadly oval. Pygidium as in type: fourth lobe small, about one-quarter the size of the other lobes. Length 0·60 mm.

Adult ♂ not observed.

On leaves of *Phyllanthus myrtifolius*. Peradeniya. May.

PARLATORIA (WEBSTERIELLA) ATALANTIÆ, n. sp. (Pl. J, fig. 28).

♀ Puparium pale yellow: occupied almost completely by the large nymphal pellicle, with a very narrow fringe of whitish secretion. Flattish: oval, the larval pellicle slightly projecting in front. Posterior parts depressed, with an indistinct median carina. Length 1 mm. Breadth 0·75 mm.

♂ Puparium pale yellow, pellicle straw-coloured: narrow elongate, with parallel sides and rounded extremities. Posterior half depressed, with indistinct median carina. Length 0·80 mm.

Adult ♀ pale yellow. No parastigmatic glands. Pygidium (fig. 28) with six broad irregularly serrate lobes. Squames elongate, narrow, with extremities very obscurely fimbriate: two in each interspace between the lobes, and two or three beyond. A few similar squames on margin of last abdominal segment. Semi-lunar pores small, rather inconspicuous, three on each side. Near the base of pygidium, on each side, is a small rounded prominence homologous with the rudimentary fourth lobe occurring in some other species of *Parlatoria*. Anal aperture central. Circumgenital glands in four small groups: upper laterals usually with 6, lower laterals with 4 orifices. Length 0·50 mm.

Adult ♂ not observed.

On undersurface of leaves of *Atalantia zeylanica*. Haragama. July.

Allied to *P. aonidiformis*: but differs in the more oval form of puparium and in its paler colour. The lobes of pygidium are much broader and less prominent.

FIORINIA BIDENS, n. sp. (Pl. J, figs. 29,30).

♀ Puparium (fig. 29) consisting almost solely of the pellicles, with little or no marginal secretion. Elongate, narrowly fusiform, highly convex. Lateral margins of nymphal pellicle deeply and irregularly crenulate: posterior extremity constricted at base of pygidium which is slightly upturned. Pygidium of nymphal pellicle with two prominent divergent lanceolate lobes and a series of large lunate marginal pores. The larval pellicle covers fully half the puparium. Length 0·72 mm.

♂ Puparium snowy white, elongate, narrow: not carinate; considerably longer and much more conspicuous than that of the female. Length 1 mm.

Adult ♀ elongate, narrow. Rostral apparatus large and conspicuous. Antennæ close together: interantennal tubercle very small. Pygidium (fig. 30) with two parallel prominent lobes of the shape of incisor teeth. Two very long spiniform squames between the lobes, and two exterior to each lobe. Circumgenital glands with few orifices, in a more or less continuous arch. Length about 0·40 mm.

Adult ♂ not observed.

On undersurface of leaves of undetermined tree. Anaradhapura. February.

CHIONASPIS SUBCORTICALIS, n. sp. (Pl. K, fig. 31).

♀ Puparium white, or grey, or brownish from intermixture of particles of bark beneath which it rests. Surface rough, granular or powdery. Pellicles pale yellow, the nymphal one concealed beneath a layer of whitish secretion. Form usually irregular and contorted; dilated posteriorly: moderately convex. Length 2 to 2·50 mm.

♂ Puparium not observed.

Adult ♀ very pale yellowish or creamy white. Oblong: broadest across abdominal area: margins of abdominal segments moderately produced. Spiracles without parastigmatic glands. Pygidium (fig. 31) with the median lobes large, prominent and very conspicuous, rounded or bluntly conical, broader than long, minutely serrate. Second lobes duplex, small, conical, inconspicuous. Third lobes obsolete or represented by serrate marginal prominences. Squames spiniform, increasing in size towards base of pygidium; none on first space, one on second, one on third, two on fourth, and four on basal space. Oval dorsal pores very large and conspicuous, the innermost series represented only by one or two marginal pores. Circumgenital glands in five groups, with numerous orifices: median group 10 to 12; upper laterals 25 to 26; lower laterals 20 to 27. Anal aperture close to median group of glands. Length 1 to 1·50 mm. Breadth 0·50 to 0·90 mm.

Eggs bright pale orange.

Beneath loose bark on stems of "Jak" (*Artocarpus integrifolia*) and other trees. Peradeniya; Matale.

Near *Ch. polygoni*: but differing in the larger median lobes, in the obsolescent third pair of lobes, and in the greater number of dorsal pores.

CHIONASPIS STROBILANTHI, n. sp. (Pl. K, fig. 32.)

♀ Puparium snowy white, or with a faint creamy tinge. Dense and opaque. Surface with a few irregular raised lines, as in *Ch. varicosa*. Ventral scale well developed. Pellicles very pale yellow. Form oblong, strongly dilated posteriorly. Length 3 mm. Breadth 1·50 to 2 mm.

♂ Puparium white; obscurely tricarinate. Densely covered with curling silky filaments. Length 1·50 mm.

Adult ♀ bright yellow. Of normal form: abdominal segments scarcely produced. Margin of thorax and abdomen with many conspicuous oval pores. Antenna consisting of a prominent truncate tubercle, with several short hairs at extremity and a stout long curved hair from the side. Parastigmatic glands at orifices of anterior spiracles only. Pygidium (fig. 32) with conspicuous median incision; the sides of the cleft occupied by the median lobes which are large, united at the base, widely divergent, the free edge minutely serrate. Second lobes minute, duplex, inconspicuous. Third lobes represented only by small marginal prominences. Squames moderately stout, increasing in size towards base of pygidium. Oval dorsal pores large and conspicuous, in linear series. Circumgenital glands in five groups, with moderately numerous orifices. Length 1 to 1·25 mm. Breadth 0·60 mm.

Adult ♂ not known.

Eggs numerous; bright yellow.

On *Strobilanthus*, sp. Haputale. February.

Allied to *Ch. megaloba*, from which it differs in the considerably larger size, in the narrower mesal lobes, and in the presence of conspicuous oval pores on the margins of the thorax.

Chionaspis coronifera, n. sp. (Pl. K, figs. 33, 34.)

♀ puparium white, sometimes tinged with ochreous: pellicles reddish. Strongly convex, the sides sloping up and forming a median longitudinal rounded ridge,—the form probably accentuated by the situation of the puparium on the extreme margin of the leaf. Length 2 mm.

♂ puparium white: distinctly tricarinate: pellicle pale yellow. Length 1·50 mm.

Adult ♀ after gestation reddish: densely chitinous, with exception of penultimate segment. Thoracic area strongly convex, the posterior dorsal area overhanging the abdomen. Early adult not densely chitinous, and of a paler colour. Rudimentary antennæ (fig. 33) of remarkable form: each consisting of a chitinous ring bearing from four to six stout spines and a central longish curved stout bristle. Behind each antenna is an oval translucent space. Other similar translucent spaces are scattered over the cephalo-thoracic area. Margins of abdominal and post-thoracic segments with numerous oval pores (obscured in the more densely chitinous examples). Pygidium (fig. 34) with large conspicuous oval dorsal pores, in more or less definite series. No circumgenital glands. Marginal squames spiniform, stout. Lobes bluntly lanceolate, small, pale and very inconspicuous: set back on the ventral surface and scarcely projecting beyond the margin. Median pair simple: second pair duplex: third pair apparently simple. In the denser examples, the dorsal area of the pygidium has some large clear oval spaces (distinct from the dorsal pores). Length 0·75 to 1·50 mm.

Adult ♂ not observed.

On leaves of undetermined tree. Galgammuwa, N. W. P. August.

The female puparia are attached to the extreme margins of the leaves. Male puparia grouped on under surface.

CHIONASPIS CINNAMOMI, n. sp. (Pl. K, figs. 35,36.)

♀ puparium reddish ochreous, usually with a broad median longitudinal brownish fascia. Form elongate, narrow : secretionary area only slightly dilated : flattish, with a more or less distinct median longitudinal ridge. Length 2 to 2·75 mm. Breadth about 0·75 mm.

♂ puparium not observed.

Adult ♀ (fig. 35) elongate, narrow; the unusual form being due to extension of the thoracic parts which occupy nearly three-quarters of the entire length. The second pair of spiracles are situated at the extreme hinder border of the meta-thorax. Pygidium (fig. 36) pointed. Median lobes prominent, contiguous, the inner edge longest, the free edge minutely serrate and sloping evenly to the margin. Other lobes obsolete. On each side, immediately exterior to the medium pair of lobes, is an elongate clavate chitinous paraphysis. Margin of pygidium irregularly indented. Squames spiniform, stout. Spines rather long. Some conspicuous oval pores on margin, but none on the discal area. No circumgenital glands. Three or four minute circular pores on each side of anal orifice which is approximately central. Length 1 to 1·50 mm. Breadth about 0·30 mm.

On upper surface of leaves of *Cinnamomum.* Pundaluoya.

In the absence of the male scale, the generic position of this species is somewhat uncertain. The form of the median lobes suggests affinities with the *Hemichionaspis* group.

CHIONASPIS THEÆ, Mask., var. CEYLONICA, n. var.

Maskell's original figures and description of the adult female are not sufficiently minute for accurate determination. But a study of specimens collected by Dr. (now Sir George) Watt, near Kurseong, India, agree more closely with Maskell's type, in the form of the puparium (which is broadly dilated behind)—than with the Ceylon form (which is very narrow and elongate). The Indian examples also show a distinct second lateral lobe which is entirely wanting in examples from Ceylon. I must therefore consider the latter a well-marked variety for which I now propose the name *ceylonica.*

LEUCASPIS COCKERELLI, (de Charmoy). (Pl. K, figs. 37 to 40.)

Fiorinia cockerelli, de Charm., Proc. Soc. Amic. Scien., p. 33, (1899).

♀ puparium (fig. 37) elongate, very narrow, almost linear, tapering to a point at each extremity. Moderately convex, with a well-defined sharp median ridge. Puparium almost completely occupied by the large nymphal pellicle which is of a dark reddish-brown colour. Secretionary area thin and diaphanous, except along the median ridge, where it is thickened and forms a white crest. There is a narrow secretionary extension in front of the larval pellicle, and an abruptly narrowed extension at the posterior extremity of the puparium. Ventral scale very thin and delicate: easily ruptured. Larval pellicle long and narrow. Total length of puparium 2·50 mm. Length of larval pellicle 0·75 mm. : nymphal pellicle 1·60 to 1·75 mm. Greatest breadth of puparium 0·50 mm.

♂ Puparium not observed.

Adult ♀ (fig. 38) elongate narrow : broadest across abdominal area. Pale violaceous, tinged with red. There is an almost complete series of coarsely serrate processes—marginal on the pygidium, but carried inwards along the ventral surface of the body, gradually increasing its distance from the actual margin and closely embracing the rostrum. Rudimentary antennæ close to rostrum. A small stout thorn-like spine in front of and exterior to each antenna. Posterior margin of pygidium (fig. 39) with four narrow prominent sharply pointed lobes, each with a more or less conspicuous smaller point on its lateral edges. Squames long, narrowed at base, dilated and deeply fimbriate at extremity: two in each interspace and three exterior to the lobes, beyond which are the serrate processes described above. Dorsal pores minute and inconspicuous. Circumgenital glands in nine groups, four supplementary groups being anterior to the normal five—(see fig. 38). Length 0·75 mm.

Margin of nymphal pellicle (fig. 40) with four tricuspid lobes and broad deeply fimbriate squames. A series of broad lunate marginal pores.

Eggs violaceous.

On *Dracæna cantleyi* and *Pritchardia grandis*, in the plant-houses, Royal Botanic Gardens, Peradeniya. On the *Pritchardia*, the scales—though numerous—are very inconspicuous, being ranged along the prominent ridges of the leaf, near the base, where they resemble small adpressed scaly hairs.

Originally described from Mauritius, under the name of *Fiorinia cockerelli*, de Charmoy. The marginal fringe and supplementary gland groups are characters that suggest its more proper inclusion in the genus *Leucaspis*.

EXPLANATION OF PLATES H to K.

Plate H.

Fig. 1 *Aspidiotus longispinus* ; pygidium of adult female.
,, 2 ,, *cuculus* ; adult female, ventral view.
,, 3 ,, ,, ; pygidium of adult female.
,, 4 ,, *pedronis* ; pygidium of adult female.
,, 5 ,, *maleollus* ; adult female, ventral view.
,, 6 ,, ,, ; pygidium of adult female.

Plate I.

Fig. 7 *Aspidiotus cistuloides* ; puparium of female.
,, 8 ,, ,, ; pygidium of adult female.
,, 9 ,, *quadriclavatus* ; pygidium of adult female.
,, 10 ,, *taprobanus* ; pygidium of adult female.
,, 11 ,, *phyllanthi* ; pygidium of adult female.
,, 12 ,, *occultus* v. *elongatus* ; galls of female.
,, 13 ,, ,, ; pygidium of adult female.
,, 14 *Odonaspis penicillata* ; puparium of female.
,, 15 ,, ,, ; male puparium.
,, 16 ,, ,, ; pygidium of adult female.

Plate J.

Fig. 17 *Aonidia echinata* ; puparium of female.
,, 18 ,, ,, ; adult female, ventral view.
,, 19 ,, ,, ; pygidium of adult female.
,, 20 ,, *pusilla* ; puparium of female.
,, 21 ,, ,, ; pygidium of adult female.
,, 22 ,, *spatulata* ; terminal joint of male antenna.
,, 23 ,, *mesuae* ; adult male, dorsal view.
,, 24 *Gymnaspis spinomarginata* ; adult female, ventral view.
,, 25 ,, ,, ; margin of pygidium.
,, 26 *Parlatoria proteus* ; margin of female pygidium.
,, 27 ,, *pergandii* v. *phyllanthi* ; puparium of female.
,, 28 ,, *atalantiæ*; pygidium of adult female.
,, 29 *Fiorinia bidens*; female puparium, ventro-lateral view.
,, 30 ,, ,, ; pygidium of adult female.

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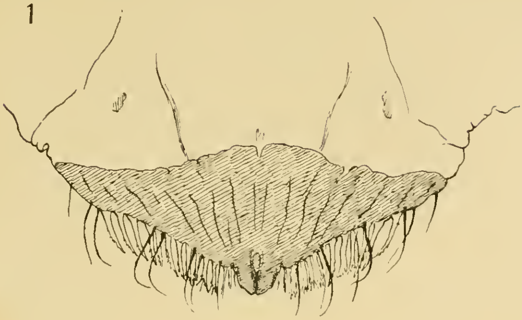

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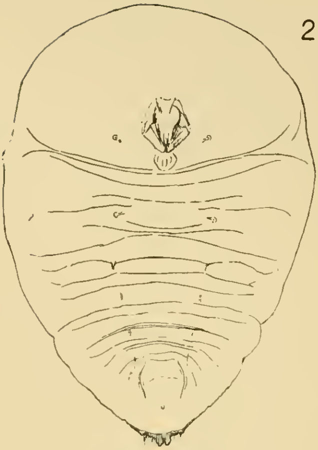

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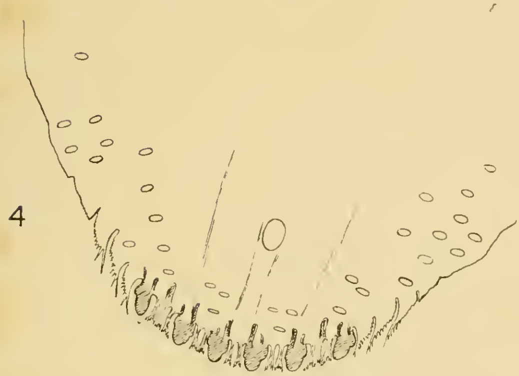

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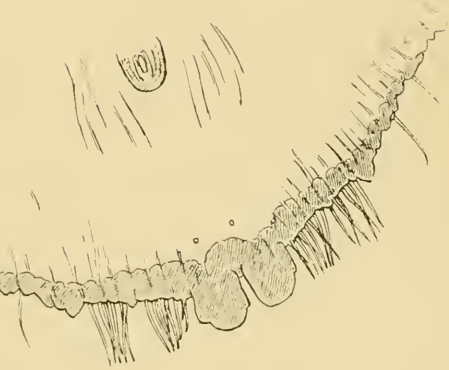

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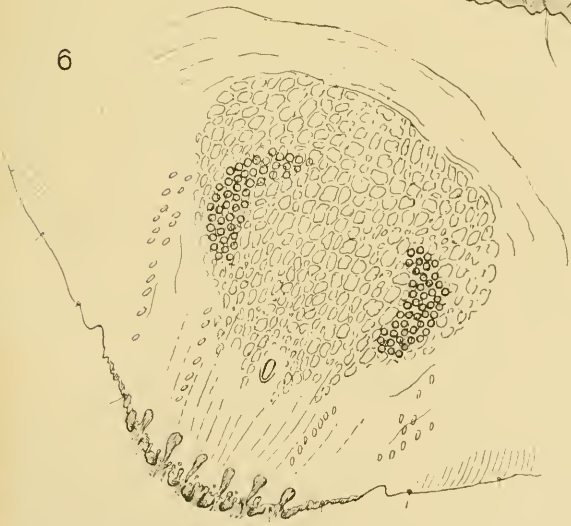

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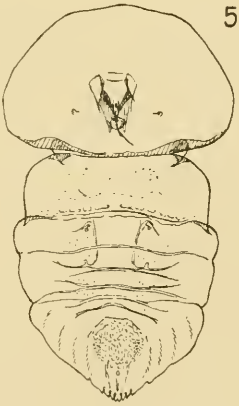
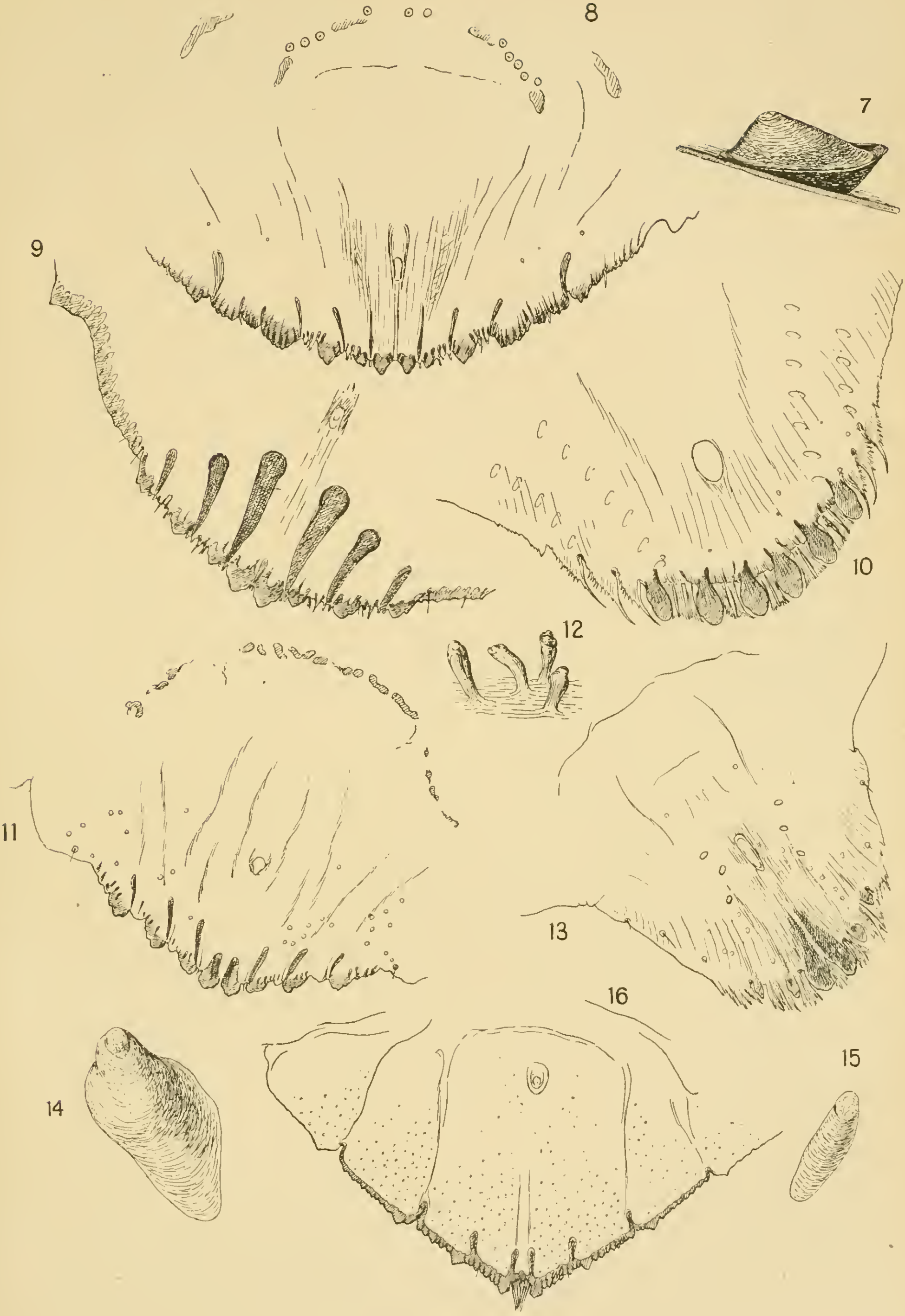


E. E. Green del.

CEYLON COCCIDÆ

PLATE I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CEYLON COCCIDÆ

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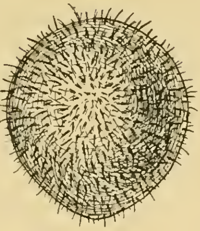

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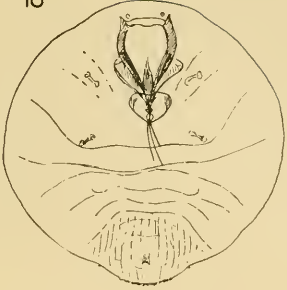

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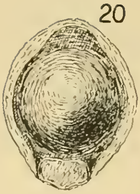

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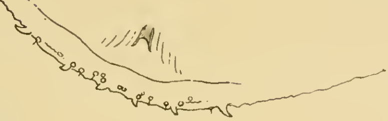

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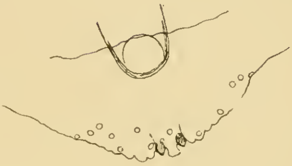

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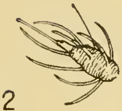

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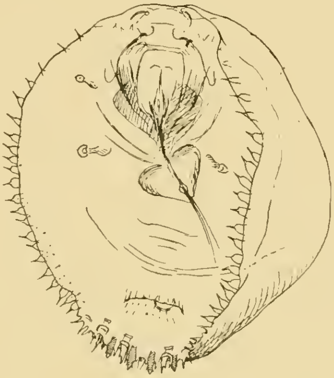

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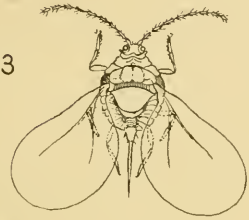

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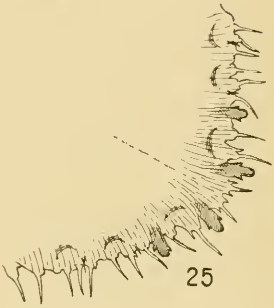

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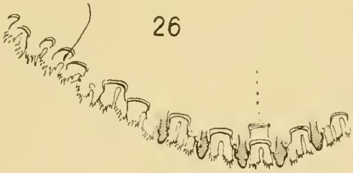

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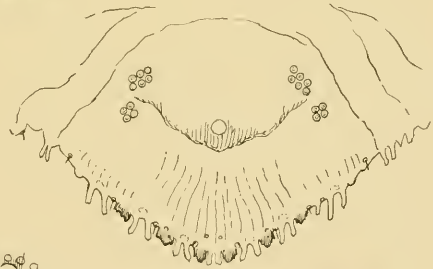

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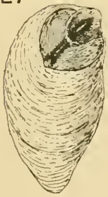

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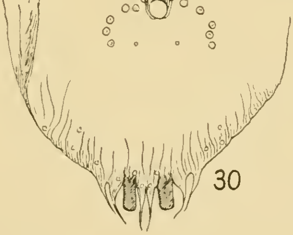

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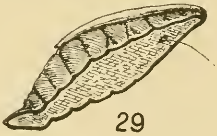

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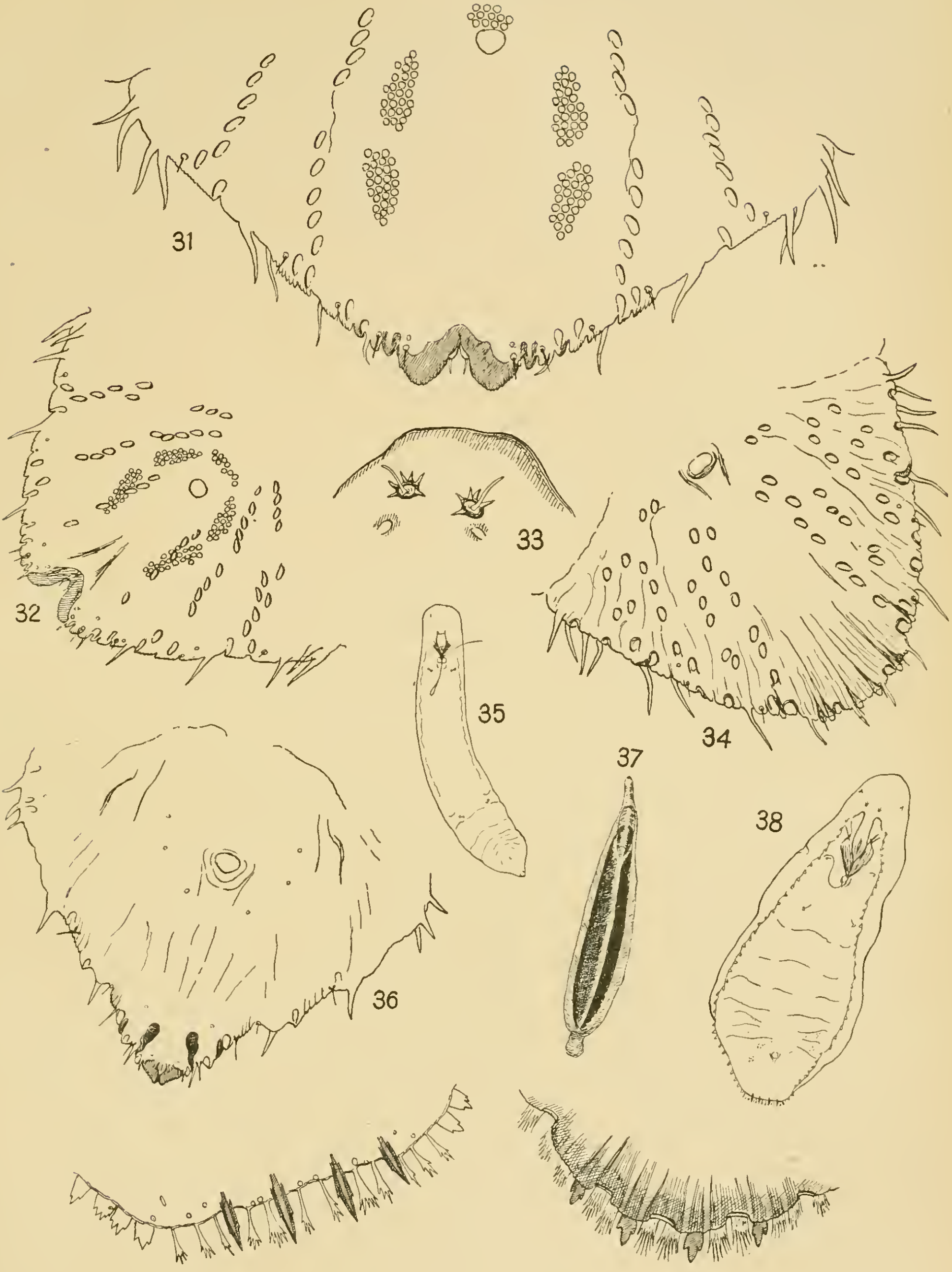
CEYLON COCCIDÆ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E. E. Green del.

CEYLON COCCIDÆ

Plate K.

Fig.	31	*Chionaspis*	*subcorticalis*;	pygidium of adult female.
,,	32	,,	*strobilanthi*;	pygidium of adult female.
,,	33	,,	*coronifera*;	antenna of adult female.
,,	34	,,	,, ;	pygidium of adult female.
,,	35	,,	*cinnamomi*;	adult female, ventral view.
,,	36	,,	,, ;	pygidium of adult female.
,,	37	*Leucaspis*	*cockerelli*;	puparium of female.
,,	38	,,	,, ;	adult female, ventral view.
,,	39	,,	,, ;	pygidium of adult female.
,,	40	,,	,, ;	pygidium of nymphal pellicle.

(Owing to reduction during photo-process, it is impossible to give the exact amount of amplification of the several figures).

NOTES ON SMALL MAMMALS IN KASHMIR AND ADJACENT DISTRICTS.

By Colonel A. E. Ward.

(*Read before the Bombay Natural History Society on* 16*th March* 1905.)

I am asked to contribute a short paper "showing what has been done and what remains to be done in research after the small mammals of Kashmir." I scarcely know what to write, for very little has been accomplished; a few definite results have been attained, but a good deal of the nomenclature is provisional, and it is hoped that our knowledge may shortly be supplemented.

The drawback to rushing into print at this stage is that much may have to be unsaid. To clearly point out how backward our collections are I take the liberty of quoting a letter sent to me by Mr. Oldfield Thomas last September; in it he writes:—"I doubt if you realize that we have *no* specimens except yours of the commonest Kashmir species, or indeed of India generally (except from Wroughton) and, therefore, we have none with the data measurements, &c., that now-a-days make the chief value of specimens, &c."

It is not very difficult to collect animals that live above ground, but burrowing mammals are hard to deal with, hence progress is very slow.

We have practically settled that *Mus vicerex* is the common rat of Kashmir. It belongs to the *rufescens* group, and is described by Mr. Bonhote—"Annals and Magazine of Natural History," Ser. 7, Vol. XI, May 1903.

Mus mettada has been identified and was caught in Eastern Kashmir at elevations varying from 7,000′ to 8,000′, and other specimens are now under consideration; this rat is described in the "Fauna of India." I was much surprised to find the Metad at high elevations.

Mus decumanus. All the Kashmir specimens which we had provisionally marked as such, turn out to be *vicerex,* but the brown rat is to be found in Poonch and in many other parts. *Nesocia hardwickei* (the short-tailed mole rat) is fairly common in the outside ranges and has been procured in Poonch.

Mice are at present engaging attention. The common mouse which swarms in the rice fields in autumn, and also lives in the villages, has been provisionally admitted as *bactrianus* (the Persian Field-mouse).

Mus arianus (the Persian Long-tailed Field-mouse) has up to date been only found at considerable elevations, where it burrows in the grassy slopes, and is partial to places where sheep have been folded in the summer. This little rodent is very hard to trap, and seems to be found in small colonies only.

Mus sublimis (the Upland Mouse) may possibly be the common mouse of Ladak, but whether the mice which have been collected in Western Tibet, and the extreme northern parts of Ladak belong to this species I cannot say, and as usual I shall hereafter look to Mr. Bonhote for his kind aid.

I fully expect to find other mice, probably *Mus leggada*, naturally some form of *Musculus*, and most likely new species; what is wanted is a general collection of these animals from all the remoter districts; these should be labelled with accurate data and measurements.

I scarcely like to touch on the Voles. Up to date I have only been able to send you *Microtus brachelix* and *M. stracheyi.* I have specimens provisionally labelled *fertilis.* Mr. Bonhote tells me *brachelix* and *fertilis* are closely allied. We look to do a good deal amongst the Voles but many specimens are required, and America is ahead of us in possessing them. I can only promise that you shall have what I can send from time to time as soon as the British Museum has authoritatively named them. I have a letter from Mr. Thomas in which he most kindy offers to help in this respect.

Next in interest come the Mouse hares. The Bombay Natural History Society have specimens of a new species; those I first sent were provisionally labelled as Royles vole (*Lagomys roylei*) but have now been named wardi. The papers thereon are not yet through the press. Mr. Bonhote has sent me a list of mouse hares, and amongst these we have found *L. curzoniæ* at Hanle, Ladak, at an elevation of about 13,500′, and *ladacensis* (provisionally named) in Western Tibet, and also in the Changchenmo Valley.

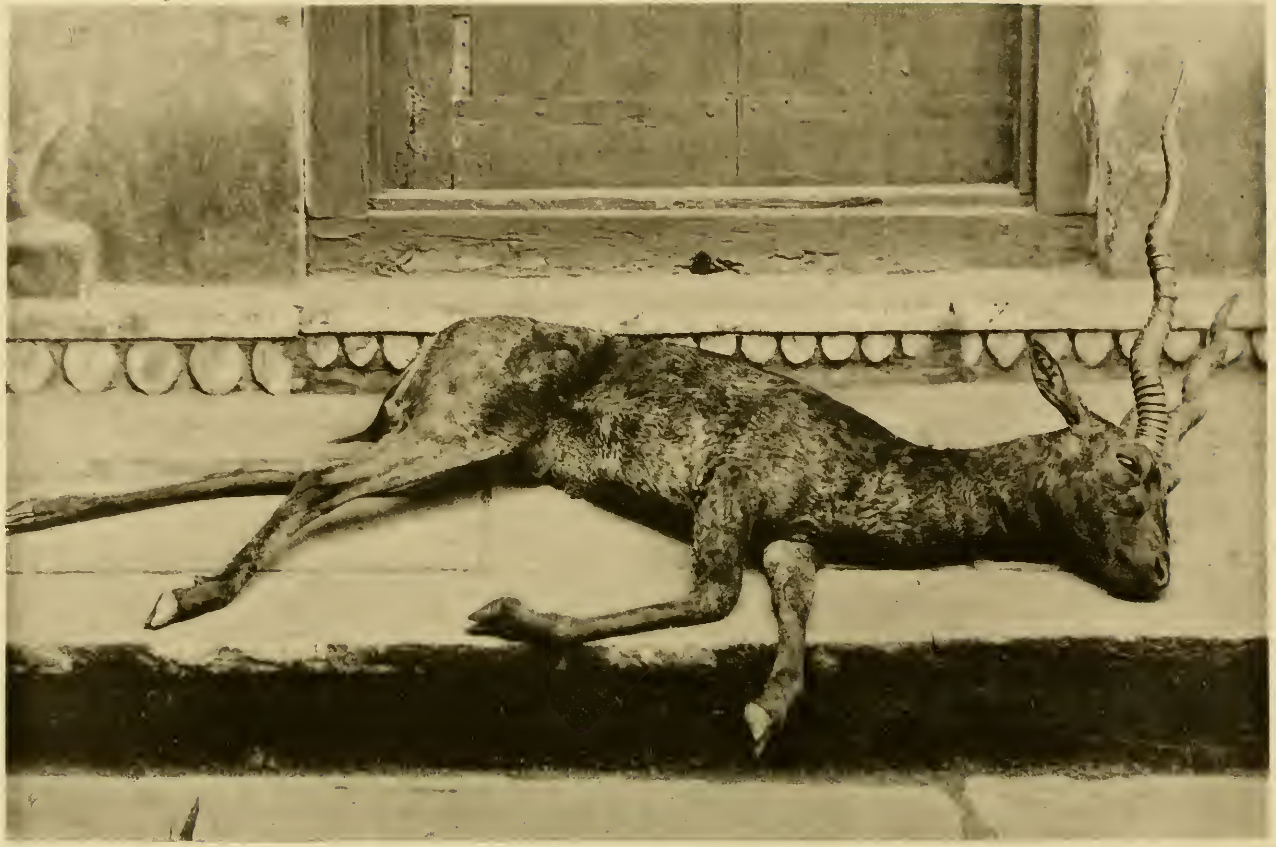
To turn to the list which is purely tentative, we may look for *erythrotus* and *rutilus* described as closely allied. *L. ladacensis* and *ozotona* which may be bracketted together for the present; *kloslowi* from Southern Tibet; *curzoniæ* and its ally *melanostomus* from Tibet; *hodgsoni* from Ladak; and *auritus* which may be the same as *griseus* (Bonhote); whilst *macrotis* and *auritus* (Blanford) are said to be identical.

I am afraid there is little to be gained at present by the perusal of the above, what we want is many specimens, my only object in dwelling on the mouse hares is the hope that some one will help to remove the difficulties under which we work.

Turning now to the *Insectivora*—*Crocidura murina* is very plentiful. I have captured this musk shrew in the jungles and in houses; with the exception of these species the only other specimens I have are *Chimarrogale himalayica*, the Himalayan Water Shrew. This is a bold little creature and has twice been secured owing to its having attacked small fish which were being landed. Years ago I found the Tibetan Water Shrew but unfortunately lost the specimen whilst on my return journey.

Mr. Thomas is asking for a large series of Marmots. I am afraid we cannot do much from the N.-W. Himalayas. The Tibet Marmot (*Arctomys himalayanus*) I have sent to the British Museum, and it will be easy enough to collect any number of the Red Marmot (*A. caudatus*).

The other small mammals, which are of interest, are hares, and squirrels. Bats are, I believe, very much required, but they are perplexing, and all that I can do is to try and collect those that come in my way; these I am sending to the British Museum from time to time and any duplicates I hope to secure for Bombay.



Mintern Bros. Photo. imp. London

MELANISM IN BLACKBUCK.

In this instance the usual white on the belly and inside of the limbs is absent.

MISCELLANEOUS NOTES.

No. I.—MELANISM IN BLACK BUCK.

(With a Photograph.)

I am sending you herewith a photograph of a Black Buck (*Antilope cervicapra*) shot here by Sahibzada Nasrullah Khan, the eldest son and heir of Her Highness the Begum of Bhopal. As you will see, it is dark-coloured throughout, without the usual white belly and legs.

The Sahibzada has shot many hundred bucks, but has never seen a similar specimen before.

It is, I suppose, an instance of melanism.

J. MANNERS SMITH, MAJOR.

BHOPAL, C. I., *6th September*, 1904.

No. II.—A RARE INDIAN GAME-BIRD, THE MOUNTAIN QUAIL *(OPHRYSIA SUPERCILIOSA*, GRAY*)*.

Judging by the enormous number of sportsmen in India who indulge in small game shooting, it is very extraordinary that one of our recognised game-birds should have been entirely lost sight of for thirty years or so. I refer to *Ophrysia superciliosa* (Gray), the so-called Mountain Quail. Whether it should rightly be described as a quail, a partridge or a pheasant still remains to be proved, but so far as is known its proper place is somewhere between or near the Blood Pheasants *(Ithagenes)* and the Spur-fowls (*Galloperdix*). It was first described in 1846 from a specimen in the great Knowsley Menagerie, which was believed to have come from India. Subsequently a few specimens were obtained close to Mussooree between 1865 and 1868 during the cold weather, but since then only one single specimen has been shot, in 1876, near Naini Tal. Whether it is a resident or a winter visitor from some cold climate is uncertain, and except that it is reported to have been found in small coveys of six or ten which skulked in grass jungle and brushwood, nothing much is known of its habits and nothing whatever of its life history.

It is with a view to encouraging any of our members, who may have the opportunity, to keep a look-out for this rare bird, that I call attention to its existence, of which few probably are aware. I am sure that many of our enthusiastic ornithologists would be proud to have their names coupled with it as its re-discoverer! Under the circumstances perhaps I may add a few words briefly describing its general appearance. In size it is about halfway between a quail and a partridge—say 10 inches in length—with a 3-inch tail and a 3½-inch wing. The plumage is long and soft, the general colour of the male being olive-brown with black and white about the head and throat, and of the female cinnamon-brown with greyish pink about the head and neck. The bill and legs are red.

If by any chance any reader of this note should be lucky enough to come across the bird it is to be hoped that he will be able to find some means of preserving the body in spirits or formalin as well as the dried skin, in order that its anatomical characters may be investigated.

E. COMBER, F.Z.S.

BOMBAY, 22*nd October*, 1904.

No. III.—*SIMOTES SPLENDIDUS.*

In Volume XIII, page 537, "Miscellaneous Notes," is published a note by Captain Wall and myself "On the occurrence of *S. splendidus* in Burma or a probable new species." The specimen was a peculiar one, in that there were four præfrontals as well as internasals, and we were inclined to consider it an abnormal *splendidus* or a new species. I have now no doubt as to its being the former.

I have since seen two specimens of this snake, evidently rare, as the description in Boulenger's work "Reptilia and Batrachia" is from the single specimen at that time known. It certainly is a very rare reptile here.

All three specimens are from Upper Burma, *viz.*, Sagaing, Ruby Mines and Yamethin districts. In the two specimens above referred to—one young, the other an adult—the internasals are four in number, and the arrangement is as before described, *i. e.*, the median pair small and projecting back to the præfrontals. The præfrontals are in each specimen two.

In the young specimen the—

Ventrals are	...	174.
Subcaudals	...	35-37?
Scales	...	21.
Length	...	11½"
Tail	...	1⅜"

As regards colouring, it agrees with that given by Boulenger except that the indentation in the spots before and behind are not as pronounced in the young as in the adult, and I cannot discern the faintest trace of a yellowish median line. There are 17 spots on the body and 3 on the tail.

On the 23rd October while returning to camp along a ridge, perhaps a 1,000 ft. elevation, I noticed, lying at full length and motionless on my path, a *Simotes* which I thought from the previous specimens must be a *splendidus*. It had recently sloughed and was indeed most beautifully marked. It made no attempt to move, though there was long grass a foot distant, until I struck it, when it dilated its neck in the manner some specimens of *T. stolatus* or *T. piscator* do when irritated, and hissed quite audibly, so much so that my tracker remarked it was like a Mwe-bwe (Russell's Viper), but not so loud. When I placed the stick close to its head, it struck. On arrival in camp the Burmans declared it was a very young python, no doubt owing to the beautiful marking.

Ventrals	...	175.
Subcaudals	...	43.
Scales	...	21.
Length	...	28¾"
Tail	...	4"

There are 16 spots on the body and 4 on the tail.

GEO. H. EVANS, A.V.D., F.L.S., MAJOR.

RANGOON, *November*, 1904.

No. IV.—NOTE ON THE DIGESTION OF EGGS BY COBRAS AND DABOIAS.

With reference to Mr. C. P. George's Note printed on page 174 of this volume, and in accordance with a suggestion made by Mr. Phipson at the last meeting of our Society, I have made the following experiments with the live snakes at my disposal at the Government Laboratory, Parel, with a view of ascertaining how long snakes take to digest a hen's egg if swallowed with the shell intact.

Our first attempt was a failure, in so far as the egg broke in the cobra's gullet while being pushed down.

No trace of the egg or its shell could be found next day on palpating the snake's body. The animal passed a motion 16 days afterwards, in which a few pieces of egg shell were observed.

The second cobra was successfully fed with an entire egg, by using long forceps to open the gape, and by oiling the shell freely. When examined on the following day, a bulging was noticed about $\frac{2}{3}$ down the body, which proved to be the egg. On feeling this lump a distinct crackling was felt, pointing to the commencing disintegration of the egg. Twenty-four hours later all trace of the egg had disappeared.

A third cobra was similarly fed with a like result.

It thus appears that the cobra requires 48 hours to digest a whole fowl's egg.

In the case of the Russell's viper it was found impossible to introduce even a bazaar egg, so we had to content ourselves with pigeon's eggs.

The result was the same as in the case of the cobra, *viz.*, the egg could be felt after 24 hours as a softish lump which crepitated distinctly under the fingers, and it had disappeared entirely in 48 hours.

W. B. BANNERMAN, M.D., Lt.-Col., I.M.S.

Plague Research Laboratory, Parel.
Bombay, *November*, 1904.

No. V.—DO WILD ANIMALS EVER DIE OF INTESTINAL OBSTRUCTION.

In the course of numerous *post-mortem* examinations on animals from the Victoria Gardens, Bombay, two cases of death from obstruction caused by the presence of foreign bodies have come under the notice of the officers of this laboratory. It strikes one as incongruous that such miscellanous feeders as the bear and Cassowary should thus die, yet the following proves that, in captivity at least, such is the fact.

CASE I.—In September 1903, a common Indian Black Bear died of some intestinal trouble in the Victoria Gardens, Bombay.

It was sent here for examination, and the cause of death was found to be peritonitis due to perforation of the small intestine caused by the impaction of a mango stone.

CASE II.—In October 1904, a dead Cassowary was received from the same gardens.

The bird was reported to have been ill for some time with "liver complaint."

An examination revealed the presence of a small green cocoanut in the gizzard, which completely filled it.

This organ was acutely inflamed, and the first portion of the gut below the gizzard was also inflamed, and showed many points of hæmorrhage.

Now it is reasonable to suppose that the Cassowary being a desert bird may not have known what a green cocoanut was and sampled it out of curiosity, but one would think a bear would be familiar with mangoes and have learned to avoid such fruit if found to disagree.

Can any one throw light on this point, *viz.*, do wild animals die in the jungle from such mishaps as the above?

W. B. BANNERMAN, M.D., LT.-COL., I.M.S.

PLAGUE RESEARCH LABORATORY, PAREL.
BOMBAY, 22*nd November*, 1904.

No. VI.—KING-CROWS AND MYNAS AS MESS-MATES.

Some time ago I noticed that a king-crow (*Dicrurus ater*) was frequently to be seen squatting motionless on the ground in the midst of a little gathering of mynas (*Acridotheres tristis*). At the time I paid but little attention to the matter; but further observation showed that the presence of the king-crow was a very common phenomenon. Consequently I formed the habit of watching for flocks of mynas feeding on the ground and then looking to see whether a drongo was in attendance. To my astonishment I found that he is more often present than absent. I may safely say that in Madras a number of mynas feeding without a king-crow in attendance is at the present season the exception rather than the rule. If the birds are feeding on an open *maidan*, the king-crow stands on the ground; if, however, there are trees, posts or other perches handy, the drongo settles on them rather than on the grass. I believe that this is a case of commensalism. The king-crow keeps near the mynas for the same reason that they attend cattle, that is to say, in order to profit by the commotion the moving beast or bird causes among the insects that live on the surface.

A king-crow may often be seen squatting on the ground at a distance from any other birds; when this is so the drongo usually hops about and picks insect food from off the ground. In the presence of mynas he behaves very differently; he sits motionless, but keeping a sharp look-out, and now and again takes a little flight after some tiny insect which I believe has been put up by a moving myna. The king-crow and the mynas share the insects between them: the latter take chiefly those which keep to the ground, while his royal highness makes short work of any which take to their wings when disturbed. I am convinced that this is a genuine instance of commensalism and not merely chance company. Firstly, the presence of the single king-crow among a company of mynas is too frequent to be a mere chance association, and secondly, the drongo moves with the party of mynas. If the grass be at all long, it is difficult to distinguish between the mynas and their companion, for the tail of the latter is hidden and from a little distance the colour of both species looks the same. The king-crow, however, does not walk about as the mynas do ; he is the one stationary member of the little company. Hence he is soon left behind: but before his beaters have moved far, he flies after them and alights in the midst of them. On one occasion, I watched, for over half an hour, a flock of eleven mynas and the attendant drongo. The latter kept near the grasshopper-hunters the whole time, sometimes in the midst of them, sometimes a little way behind, while occasionally he would fly ahead in the direction in which the little flock was moving. In the course of my watching, the birds on two occasions took fright at something and each time flew away to some distance. As soon as the mynas again settled down to feed, the king-crow joined them. On one of the occasions the latter gave the alarm and flew off, hurriedly followed by the mynas ; on the other the mynas took the lead, followed by the drongo. It is rare to see more than one king-crow with a company of mynas. The reason of this is, I believe, that the king-crow likes to be "cock of the walk." Having attached himself to one party of mynas he looks upon their hunting-ground as his special preserve for the time being, and resents the intrusion of others of his species.

If a second king-crow comes up, a fight ensues, and the stronger bird allows the weaker no peace, constantly giving chase until the latter departs. The king-crow does not appear to attach himself permanently to one flock of mynas. On a large piece of ground I have seen four separate flocks of mynas each with a king-crow in attendance, and the drongos sometimes change flocks just as one's fox-terriers, when half way through their meal, change plates ; each seems to covet his neighbour's possessions, and the exchange appears to give satisfaction to both parties.

Knowing what a little tyrant the king-crow is, I always look carefully to see whether he commits robbery on the mynas. Only upon one occasion have I found him guilty of this offence, and the circumstance is, I think, sufficiently remarkable to be recorded.

I was watching some mynas feeding on the grass in the Botanical Gardens, Madras, when suddenly a king-crow, which I had not observed, swooped down upon one of the birds, planted his claws in its back and pecked most viciously at its head. While punishing the myna the king-crow uttered his harsh note of anger. The myna too made a great outcry, and wriggled away, but the king-crow again attacked it from overhead. The scuffle was so violent, and the movements of the birds so rapid, that it was difficult to see exactly what happened. After the contest had lasted from forty seconds to a minute the king-crow flew off, carrying in his beak what I at first took to be a myna's feather. Fortunately the drongo settled in a tree a few yards from me. I immediately turned my glasses on to him and then saw that what he had in his beak was a wriggling worm. This had been the bone of contention. The king-crow had evidently, before I noticed him, been watching the myna and, seeing it unearth the worm, the little robber fell upon it with beak and claw. However, he seemed to find the worm more difficult to swallow than to capture. The worm could not have been less than two inches in length and the drongo had hold of it by one end. His efforts to dispose of his wriggling victim were amusing to watch. Presently the worm wriggled itself free and fell. The king-crow swore vigorously and dropped after it, but he had not to descend far, because the luckless worm caught in the petiole of a leaf. The drongo again secured it, took it to a broad branch, and after grappling with it for about a minute swallowed it whole.

Highway robbery of this description is, I think, not common. In most cases the mynas appear to be on excellent terms with their black neighbour : they strut about quite close to him, and behave as though they were unaware of his presence. I have never seen them make any attempt to mob him. Except upon the occasion just mentioned I have not seen the drongo attack the myna. Such attacks cannot be very frequent, for so courageous a bird as the myna would never tolerate the presence of the king-crow if he frequently committed larceny.

I believe that the arrangement is merely one of commensalism. The king-crow benefits, hence his presence. He as a rule does not harm or impede the mynas, for he takes the insects they do not trouble to chase, and, indeed, he is sometimes useful as a sentry, so they tolerate his presence.

King-crows very frequently use cattle as perches. No sight is commoner in India than that of a king-crow perched on the back of a cow, sufficiently far forward to avoid the swish of the tail. Until recently I was under the impression that the drongo utilised the quadruped merely because its back formed a convenient point of vantage whence he could obtain a good view of the surrounding country. I am now inclined to think that the king-crow derives the additional advantage of having the ground beaten for him by the moving cow. The myna uses cattle as beaters ; why then should not the drongo do likewise ?

I must confess that until recently I had not noticed this commensalism between the king-crow and the mynas, and since I have noticed it I have not been outside Madras, so cannot say whether a similar relationship exists elsewhere. I am inclined to think it does, and has not been noticed, because mynas being such very common birds naturalists are apt to pay but scant attention to their doings. Moreover, seen from a distance a king-crow sitting on the grass is easily mistaken for a myna. Again, the present season in Madras has been an exceptionally dry one ; it is therefore possible that the king-crow is more dependent than usual on the insects which frequent the ground.

I shall be interested to know whether other members of the Bombay Natural History Society have noticed this case of commensalism.

D. DEWAR, I.C.S.

MADRAS, *December*, 1904.

No. VII.—OCCURRENCE OF THE SCAUP DUCK (*NYROCA MARILA*) IN OUDH.

On Sunday 11th December last our bag contained among others a scaup duck (*Nyroca marila*) which flying solitary fell to Captain K. L. W. Mackenzie's gun. It was much damaged as a specimen, but I have sent the skin to the British Museum. Oates in his book "The Game Birds of India," Vol. II, pp. 337 *et seq.*, mentions this duck as a rare winter visitor, and nearly all the few records he mentions of its occurrence in India are from places considerably north of this. I may mention that one specimen of the marbled duck (*Marmaronetta angustirostris*) was obtained by Major H. A. Cooper the same day.

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Since writing the above I have met the Revd. J. Gompertz, Senior Chaplain of Fyzabad, an experienced and enthusiastic sportsman who has kept detailed notes of his bags for some years. He tells me he has several times shot the scaup duck in Oudh and elsewhere, proving that Oates' remark (The Game Birds of India, Part II, p. 338) as to its being probably a commoner duck than records lead us to suppose, is correct. My informant has very kindly allowed me to make the following extracts from his note book relative to shooting this duck :—

Date.	Number.	Locality.
19th January 1897 ...	1	Parbattia, Gonda District, Oudh.
26th January 1897 ...	1	Ditto.
9th November 1898 ...	1	Kadir Talao, Roorkee District.
30th November 1898 ...	1	Ditto.
21st December 1898 ...	1	Ditto.
28th December 1898 ...	1	Ditto.
15th November 1899 ...	1	Ditto.
29th November 1899 ...	1	Ditto.
14th January 1903 ...	1	Raniarpur, Oudh.
1st December 1903 ...	1	Quaila, Wr. Akbarpur, Oudh.
7th December 1904 ...	1	Barabanki District, Oudh.

F. WALL, Captain, I.M.S., C.M.Z.S.

FYZABAD, 14*th January*, 1905.

[The Scaup has been recorded as far south as Bombay, shot by Mr. J. D. Inverarity, *vide* this Journal, Vol. II, page 97.—EDITORS.]

No. VIII.—LUMINOUS PLANTS.

There are many things in nature of which the average person is ignorant. It would perhaps surprise him to be told that several species of fungi are luminous. Some years ago Mr. G. A. Gammie, now Professor of Botany in the Poona College of Science, contributed to our columns an interesting article on "Luminous fungi." Since then we have seldom come across any reference to luminous plants. Close observers, for instance, have noticed that our common Tuberose lily (*Polyanthes tuberosa*), the "Gool-i-shubbo" of the natives, gives off sparks on a hot evening. We have noticed these sparkling emanations from a bunch of tuberoses on a dark hot night, and they have seemed to us to partake of the nature of electric sparks. Of course, the light may have been phosphorescent, but it is not improbable that, under the influences of heat and electricity, combined with moisture, several tropical plants might exhibit a brilliant light. A writer in the *Journal of Horticulture* recalls an incident of some sixty years ago when there was exhibited before the Royal Asiatic Society the roots of a singular plant, presumably a species of Orchis, which grew amidst the jungle below the Madura Hills, in India. It was phosphorescent, and even if dried could be made to shine with the brightness of a glow worm when the surface had a wet cloth applied for a short time. The editor of the *Gardeners Chronicle* found that a small piece of this root retained its power of lighting up a good while, only the light got feebler. The Brahmins, it was said, knew its peculiarity but all the plants did not possess this luminosity at their roots. They imagined the light of it drove away demons. Amongst the Himalayan hills the natives describe slopes and valleys that are lighted up on damp nights by some species of grass, as they think, possibly it is by crawling luminous insects.

The same writer tells us that what is commonly known as "touchwood," and, on account of its rapidly kindling property, is used for lighting fires, is apt to be luminous. Schoolboys for generations have been in the habit of carrying pieces of such wood into their dormitories to produce a sudden illumination at night. The wood of the Willow is specially notable for its readiness to take fire. In the Northfleet Marshes, near Gravesend, the writer saw numerous old Willows that had been almost stripped of bark, with the surface of the wood blackened as if burnt. It would seem the wood was scorched by a spark from some pipe, or by the fierce rays of the sun, but did not burn away. Perhaps, since its luminosity can sometimes be developed by friction, touchwood may retain heat, though we usually ascribe its brilliancy to phosphorescence. What is singular also, the sap of some trees in exotic regions appears luminous, as it flows from a wound. One shrub, indeed, has been named *Euphorbia phosphorea* from this fact, and there are other instances. We have it on the authority of the late Professor Henslow that the European Dittany, *Dictamnus fraxinella,* evolves some inflammable gas in the evening, and, should the air be still, if a light is brought near, the plant will be enveloped in a transient flash, but receives no injury. Before his time the daughter of Linnæus had stated that a plant of *D. albus,* which she approached with a candle, became surrounded by a light blue flame. Dr. Hahn suggested the Dittany might produce hydrogen or evolve an ethereal oil from the flowers; he made many experiments amongst species of Dictamnus unsuccessfully, but at last found a rather faded plant, from which, when he held a match, came a reddish crackling flame, having an incenselike smell. Then he ascertained this can only happen during the limited period of the flower's fading, and also that there are glands containing an aromatic oil. A Himalayan species of the genus has the reputation of making a brilliant display after dark, even when not approached by a light.

The writer we have quoted records also that electricity is said occasionally to have a peculiar effect upon the garden Tuberose (*Polyanthes tuberosa*). A plant of this has, he says, been observed, on a sultry evening after thunder to send out an abundance of small sparks, coming chiefly from such flowers as were fading. In 1843 Mr. Dowden described to the British Association a luminous appearance witnessed one August evening on the double variety of the common Marigold. This was seen by four persons. During the twilight a golden flame appeared to play from petal to petal of some of the heads, making a sort of corona round the discs. This emanation grew less vivid as the light decreased, then vanished. Most of the scientists considered this was a case of visual deception, but several years after Dr. Lankester established it as a fact, if one very exceptional. He noticed such a flame in the same species and also in the Hairy Red Poppy, the flashes of light occurring at the end of a hot dry day. Another gentleman stated that on a June evening about nine he saw flashes of light pass along three scarlet Verbenas growing a foot apart in his garden. He called the attention of his gardener and several other persons to the spot, and the sight lasted quite a quarter of an hour. There was a smoky appearance in the air after the flashes, which reminded one of the summer lightning in miniature. Subsequently the same phenomenon was noticed amongst some red Pelargoniums, and it was repeated many times during July and August, when the weather was sultry and electric. Friends are requested to watch their Chrysanthemums at dusk, since that flower is reported to be now and then luminous, presumably the white and yellow varieties. Other luminous plants are the White Lily, the Nasturtium, the Sunflower, the Evening Primroses and some wall mosses.

(Indian Planting and Gardening, 17th December 1904.)

No. IX.—AN EGG-EATING COBRA.

With reference to Mr. C. P. George's note on Cobras feeding on eggs, page 174 (No. XXII) of this Volume, I enclose a photograph taken by me a short time since of a large-sized cobra killed on a Guinea-fowl's nest; the nest contained 15 eggs and the cobra had swallowed six.

After killing the cobra the six eggs were pressed out and set, three of them eventually hatching out. *The photograph distinctly shows the distention of the snake.

BANKIPUR, 1st *January*, 1905. E. BROOK FOX.

No. X.—LOCUSTS.

THE COLOURING OF ACRIDIUM PEREGRINUM.

With regard to Mr. Aitken's note on the above subject on page 157 of Vol. XVI., No. 1 of the Journal, it may be of interest to note that a swarm of Locusts which visited this place in June (12th) 1901 consisted of specimens of both colours (red and yellow) in very nearly equal proportions, the red predominating slightly.

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* The photograph referred to has been placed in the Society's album.—EDITORS.

I sent 5 specimens (3 red and 2 yellow) to Mr. E. P. Stebbing, F. E. S., who confirmed the identification, so there is no error as to the species.

CECIL E. C. FISCHER, I.F.S.

CHATRAPUR, GANJAM DISTRICT,
January 5th, 1905.

No. XI.—THE HABITS OF THE LEAF BUTTERFLY.

THE RESTING POSITION OF KALLIMA.

In Mr. Aitken's note on "The Enemies of Butterflies" (Journal, Bombay Natural History Society, Vol. XVI, No. 1, p. 157) is the following passage :—"*Kallima*, when at rest on the trunk of a tree, always turns its head downwards, though this somewhat spoils its resemblance to a leaf." The author goes on to suggest that this position is assumed for the purpose of facing an enemy that may be ascending the trunk. He adds that the principal enemies would be lizards.

I cannot help thinking that Mr. Aitken is mistaken—both in his estimate of the resemblance and in his explanation of the position adopted by this butterfly. I maintain that the inverted position of the butterfly by no means detracts from its resemblance to a leaf. The colouration and pattern of the underside of *Kallima* is such as to very closely simulate a dead leaf. Dead leaves do not naturally retain an erect position: nor do leaves—living or dead—commonly grow direct from the trunk of a tree. But it is no unusual thing to see a withered leaf arrested in its fall and accidentally attached to a tree-trunk by the strands of some spider's web. It is just such a semi-detached leaf that *Kallima* resembles when resting in its customary position. To add to the deceptive appearance, the butterfly sways itself slowly from side to side, just as a detached leaf would be moved by a current of air.

As for the idea that a lizard would necessarily approach its prey from below, it seems to me that a tree-haunting lizard is just as likely to attack from above or from one side. The direction will depend entirely upon the relative position of the lizard and the butterfly at the time. Lizards of the genus *Calotes* (systematic butterfly-eaters) generally affect the extremity of a spray or end of a branch. When they do take up a position on the trunk of a tree, it is usually an inverted position, like that of the *Kallima* itself. A *Gecko*, seeing a large insect pitch on the trunk, would probably gain the level from the opposite side of the tree, then stalk its prey round the corner.

E. ERNEST GREEN.

PERADENIYA,
CEYLON, 10*th January*, 1905.

No. XII—BREEDING SEASONS OF BIG GAME IN INDIA.

Having read with interest Mr. Comber's note No. XXV in the last issue of the Journal, I beg to bring to your notice a few facts which have come to my notice during the Christmas holidays and to make the suggestion that if a large number of members who shoot would record their observations in the jungle, materials would probably be forthcoming for an inductive chain of reasoning on the subject of the breeding seasons of game.

I was shooting with three friends in a jungle in East Khandesh which abounds in Sambar and Chital. About the 20th of November, as I did not know the jungle, and dislike to ask friends to shoot in a country where I do not know my way about, I rode over and made the acquaintance of the local shikaris. They proposed a beat. We had one drive, and I killed a Chital with fair horns, to which were still adhering some sheds of velvet, but these, however, were easily peeled off. I saw other stags, but none in velvet. The beaters picked up a young Chital fawn only a few days old, which could not run, and I have it as a pet.

On December 24th our camps assembled, and we shot almost daily till January 3rd. Only two Chital were bagged. One had horns quite clean of velvet and the other was almost entirely in velvet. It was peeling only off one brow antler, and the ends of the tines were still soft. I raised my rifle once to shoot at a large stag which came quite close to me, and dropped it again on seeing that he had young horns only half grown. In another beat two stags went by with only one horn each, the others not being broken, but clean gone. One fawn only born a few days, and unable to run, was picked up, shown to me and released, and another was observed in a thicket where its dam had left it. Other fawns of various sizes were seen. Four Sambar were shot, all with clean horns and no signs of velvet, and many other stags were seen, but none had velvet so far as could be observed. Such fawns as were seen were all well grown and I should say about 6 or 8 months old. There were signs, however, on the trees that the Sambar had been scraping their horns not long ago, which would seem to indicate that they have not long got rid of the velvet.

The net results of observation of some hundreds of Chital and Sambar in the same jungle would seem to be these :—

November 20.—One Chital stag shot just finishing the shedding of velvet, One Chital fawn picked up, only a few days old.

December 24—*January* 3.—One Chital stag shot in velvet, which he was beginning to shed. One Chital stag observed with horns sprouting. Two Chital stags observed, each of which had shed one horn.

One Chital stag and many seen, with horns clean of velvet. Two newly born Chital fawns observed. Many Chital fawns in various stages of growth observed. Four Sambar stags shot, none having any velvet on their horns. Several Sambar fawns observed, all of some months' growth. Signs on trees observed of recent scraping of their horns by Sambar.

The above are simply the facts as I observed them. If some scores of similar sets of observations were collected, I fancy that from the date of the stag's horns and the size of the fawns, the breeding season might be calculated with fair accuracy.

BHUSAVAL, *9th January*, 1905. A. H. A. SIMCOX, I.C.S.

No. XIII.—NOTES ON THE "HOUBARA" (*OTIS MACQUEENI*).

The Houbara, "Tilur" of the Punjabi, has been extraordinarily plentiful this cold season in the Sirsa District, as many as 12 having been shot in one day by two guns and a total bag of 49 made by one gun between the 20th of November 1904 and the 15th of January 1905. One of the largest birds I have handled weighed 4 lbs. 2½ ounces uncleaned, and I took the following measurements with a steel tape:—

Length	29·2″
Wing	16″
Tarsus	3·85″
Tail	9·25″
Bill from gape	2·25″
Length of foot	2·20″

This Houbara (a fine male) was shot on the 11th of January 1905 and looked like a young Ostrich stalking along, except for his tell-tale ruff! This ruff is an exceptionally fine one. The longest feathers measured 6·40 long. The feathers forming the crest on the top of the head tape 3·10 and the whole plumage is in magnificent condition. I find that about this part of the Punjab the "Houbara" affects sandy hammocks intersected with crops of "rye" or mustard, and should you find such a place, and the day be still and not too cold and windy, you may have the luck to see 8 to 11 birds stalking majestically along. I find also that generally after the third flight the birds will allow you (provided you are riding or stalking behind a camel) to get amongst them, as they then get accustomed to your camel and try to escape notice by "*squatting.*" This is the time to test the powers of your own eye-sight and the observing power of your camel-driver, for a "Houbara," squatting on sand with his head laid out flat, is indistinguishable at a distance of 10 yards. It is then you will give vent to an "anathema" on all the "Otis" tribe (for should you turn away thinking that you must have been mistaken and no bird had alighted, marked you ever so carefully the spot as you thought) you may perchance get too near an old hen bird that has been there all the time and with a flap, up she will get and flap away, but covered by the body of your camel until too late to fire. The "Houbara" is not a swift flyer and is not a difficult bird to hit or bring down. The colouring of their wing covers and backs very closely resembles the sand on which they delight to live, and when "squatting," should the ground be absolutely level, the eye will pass over the bird in mistake for a clod of sand or some *debris* blown together. To get on anything like shooting terms with the "Houbara" it is advisable to circle round on your camel, when they will on a still day let you get quite close and you may shoot 5 or 6 as they get up one after the other. I. put forward the theory that on a windy day their feathers are liable to get blown up and so cause them to be detected, and this makes them impatient and impossible to approach. They feed generally in the morning and evening on seeds and insects, and there is a small weed that covers the open sandwastes in this part of the Punjab that they are very fond of. It has a small flower like a "forget-me-not." In cloudy and windy weather they feed during the middle of the day, but they are then very wild, and it is next to impossible to shoot them. Colonel Reginald Heber-Percy, of "Badminton" Library fame, who paid Sirsa a short visit at Christmas time in order to try for record Black-Buck and Chinkara heads, told me he found many "Houbara" south of this place and practically lived on them all the while he and his wife were in camp. I may add that although they were not fortunate enough to bag any record heads, Miss Heber-Percy shot a good Chink just under record dimensions. Mrs. Heber-Percy while in Kashmir during the summer of 1904 shot 2 record Thar 14⅛ and 13½ respectively, and these were officially measured for the Kashmir Record book. The Colonel and his wife left Calcutta on the 15th for Burma, as he wishes to obtain a good example of the Thamin, *Cervus eldii*, for the joint collection of his brother (Major Algernon Heber-Percy) and his own at Hodwet Hall in the old country.

A few birds began to arrive at the end of September, but they did not become plentiful till December 1st, when reports from many villagers came in of the quantities seen. The cold snap immediately following Christmas time again seems to have scattered the birds, which have since become scarce. Imperial Sand-grouse have not been at all plentiful this year, but a great number of birds travelled south and over Sirsa on the 1st, 2nd and 3rd of January. I hear since that the Imperial has been shot here near Ajmere, in Rajputana. The Houbara leave us about the 15th of March for Afghanistan and Tibet. Blanford tells us that "a few stragglers may remain and breed in the Bikanir Desert." I, however, have never seen or heard of one during the hot months, though several times I have had *kubber* brought in of the Great Indian Bustard, *Eupodotus Edwardsi*, and a fine bird weighing 16¾ lbs. was brought to me killed about 12 miles out.

Sirsa, *20th January*, 1905. REGINALD H. HEATH.

No. XIV.—OCCURRENCE OF THE BLACK-CAPPED KINGFISHER, *HALCYON PILEATA*, IN WALTAIR.

On the 15th of this month, whilst camped on the Naidupatem creek, a tributary of the Upputern river, I obtained a specimen of *Halcyon pileata*, the Black-capped Kingfisher. The Upputern river flows from the Kolem lake to the sea between the deltas of the Godavery and Kistna, and the latitude of Naidupatem is approximately 16°N, and the longitude approximately 81°67′E. The bird was sitting on the stump of a dead tree near the creek opposite to the village.

The next day I saw another specimen of the same Kingfisher near the Lutchmepuram lock on the Upputern river. I send you by post the specimen I shot at Naidupatem. This, it would appear, is the first occasion on which this beautiful Kingfisher has been reported from this locality.

Waltair, P. ROSCOE ALLEN.
Camp Chellipett, *19th January*, 1905.

No. XV.—THE BREEDING OF RUSSELL'S VIPER (*VIPERA RUSSELLII*).

Among a number of snakes which have recently died in the Plague Research Laboratory at Parel, and which Lieutenant-Colonel Bannerman, I.M.S., has been kind enough to send me, was a gravid Russell's viper whose pregnancy was remarkable for the paucity of the brood and the season of its occurrence. It contained a solitary fœtus. Now of all the snakes I know, excepting *Tropidonotus piscator*, this viper is the most prolific, as may be readily understood from the breeding notes I have collected from various sources, and herewith append in tabular form :—

Date.	Locality.	Number.	Authority.	Remarks.	Reference.
......	......	40	Dr. Anderson..	Young...	(Fayrer) "Thanatophidia," page 14.
......	Umritsar ...	18	Dr. Stoliczka...	Young deposited ...	(Fayrer) "Thanatophidia," page 55.
September 1875...	......	...	Miss Hopley...	Young deposited, Regent's Park, London.	"Snakes," page 436.
22nd April 1896...	Trichinopoly...	36	Self	Eggs with no trace of embryo.	......
1st May 1896 ...	Do.	24	Do. ...	Do. ...	......
30th June 1899...	Indore ...	63	E. C. Cholmondeley.	Young deposited; length from 9"—10".	Bombay N. H. S. Journal, Vol. XII, page 765.
20th June 1902...	......	33	W. S. Millard..	Young deposited, Society's Museum, Bombay.	Bombay N. H. S. Journal, Vol. XIV, page 614.
5th March 1902...	S. Guzerat ...	55	A. H. Mosse...	Eggs with no trace of embryos.	Bombay N. H. S. Journal, Vol. XV, page 134.
13th June 1903...	......	14	W. S. Millard.	Young deposited in Society's Museum, Bombay.	Private letter to me.
......	Burma ...	62	Major G. H. Evans.	Young deposited ...	Private letter, dated 14th August 1904.

The Assistant Surgeon at Parel Laboratary, who has favoured me with some notes on events of a domestic nature which have occurred in that Institution, says this snake produces from 20 to 40 at a birth, and always about the month of May. The embryo derived from the specimen which has evoked these remarks, measured 9½ inches, and so would probably have been born in the month of November. Reference to Mr. Cholmondeley's note shows that the length of those hatchlings that came under his notice varied from 9–10 inches, and it will be noticed that several of the young recorded by others were deposited in the months of May and June. I collected two specimens at Cannanore last year in the month of May, measuring $9\frac{5}{8}$ and $10\frac{1}{4}$ inches, respectively.

The Parel fœtus, which was developed from the left ovary, occupied a thin transparent, membranous chamber, $2\frac{1}{20}$ inches in length, which when opened allowed a little clear, oily, fluid to escape, but retained a small quantity of transparent jelly-like material which had to be picked off. It was folded into four. The 154th and 155th ventrals were perforate, and the 156th and 157th furrowed, and 17 others intervened before the anal shield. Its sex could not be discovered.

I was much struck with the length of the maternal ovaries, the right of which measured 6½ inches. I counted 89 follicles in this ovary, and found they varied from $\frac{1}{20}$— $\frac{3}{0}$ inch in length. The following comparison between the mother and fœtus is interesting, especially with reference to the scales. It is also noteworthy that in the mother the vertebral spots were not outlined whitish, whilst in the fœtus they were.

	Length.	Ventrals.	Sub-caudals.	Scales.			Vertebral spots in rosary.
				2 heads lengths behind the head.	Mid body.	2 heads lengths in front of vent.	
Mother ...	4′ 9″	174	48	27	31	23	24
Fœtus ...	9½″	173	50	28	29	24	24

F. WALL, Captain, I. M. S., C.M.Z.S.

FYZABAD, 21*st January*, 1905.

No. XVI.—THE CROCODILE; ITS FOOD AND MUSCULAR VITALITY.

I shot a crocodile 11 feet 3 inches long in the Tapti yesterday about 11 a.m. On cutting it open in the afternoon we found that the stomach contained several goat's hoofs, about 2lbs. of pebbles of various sizes, and a lot of the fleshy stalks of white lilies (*Crinums*) which grow on the banks. Is it not rather peculiar that first of all every bit of the goat or goats should have disappeared except the shells of the hoofs, and secondly that the crocodile should have included lily stalks and pebbles in its diet? Another thing I noticed was that though I smashed the base of the skull with a ·577 magnum bullet, and killed the creature outright about 11 a.m., yet the whole body was jumping and quivering about 3 p.m. when we had got the skin off and cut off the head. It was thrown out in a field, but the muscles continued jumping till sunset quite enough to move the legs perceptibly—so much so that the vultures which hovered about continually dared not touch the carcass yesterday. Is this not extraordinary vitality?

A. H. A. SIMCOX, I.C.S.

IN CAMP, BHUSAVAL.
23rd January, 1905.

No. XVII.—THE URIAL OF THE PUNJAB AND LADAK.

Sportsmen, I have been informed, find considerable difficulty in distinguishing between the various local forms of the Asiatic wild sheep known in the Punjab as the urial, in Astor as the urin, and in Ladak as the sha or shapo, and scientifically as *Ovis vigneï*; and there is little wonder in this, seeing that even naturalists (chiefly from the want of a sufficient series of specimens) are far from being in accord on these points.

The urial, or sha, is closely allied to *Ovis gmelini*, the wild sheep of Armenia and North-Eastern Persia, of which the so called *O. ophion* of the Troodoo Mountains of Cyprus is nothing more than a local race. In both these two species the colour of the coat tends more or less markedly to rufous chestnut, the rams have a large ruff of long hair on the throat, and the ewes develope small horns. The urial, or shapo, is distinguished by the colour tending very generally to fawn, but more especially by the forward curvature of the horns, which sweep along the sides of the face, and show more or less pronounced angles bordering the flattened front surface. The old rams do not show the light saddle mark which is so conspicuous in the Armenian wild sheep. So far as I can at present determine, four local forms or races of urial may be recognised, their distinctness from one another being based partly on actual physical differences and partly on geographical distributions. From this it will be inferred that it will not be possible in all cases to refer a given specimen to its respective race without knowing its place of origin. This, however, is a difficulty to which we are gradually becoming accustomed as the refinements of systematic zoology increase.

Firstly, we have the typical urin (*Ovis vignei typica*) of Astor, from which the shapo of Ladak appears to be inseparable. This Ladak urial, as it may be conveniently called, is a comparatively large form, in which the coat is fawn-coloured rather than foxy rufous. As a rule, the horns of the old rams turn markedly inwards at their tips, and have their front angles moderately prominent. Secondly, there is the Baluchi urial (*O. vignei blanfordi*), in which the horns tend to turn outwards at the tips, forming a more open spiral, and have the front angles prominent and occasionally showing a banded structure.

This race (at first regarded as a distinct species) was described by Mr. A. O. Hume in the *Journal* of the Asiatic Society of Bengal for 1877, on the evidence of the skull of a ram from the Kelat district of Baluchistan, in which the tips of the horns curve outwards, so as to form a very open spiral. So open, indeed, is the spiral that a portion of the inner surface (which in other urial is completely concealed) is visible in a front view. In a skull from Kelat, in the British Museum, the spiral is, however, much less open, and there is no marked outward divergence of the tips, still it must evidently belong to the same race. Moreover, the presumption is that the urial from the rest of Baluchistan and Afghanistan, and, in fact, from the Trans-Indus districts in general, likewise belong to *O. v. blanfordi*, as the Indus must almost certainly form an impossible barrier to these sheep. In confirmation of this view, it may be mentioned that the horns of a very fine male urial obtained by Dr. Aitchison, when on the Delimitation Commission in Afghanistan, show a tendency to form an open spiral, and have very prominent front angles. In another head in the British Museum, from the hills north of Peshawar, the front angles are more prominent than in any urial I have ever seen, and are also raised into a number of knobs, but there is no decided tendency to an out-turning of the tips, although the spiral is rather open. It is practically certain that the specimen is racially distinct from the true urial of the Cis-Indus districts. On the other hand, an urial head figured on page 383 of the third edition of Rowland Ward's *Horn Measurements*, shows a decided outward turn of the tips of the horns, and, in fact, appears to be very similar in this and other respects to the type of *O. blanfordi*. The specimen, which is the property of Major H. F. Taylor, is stated to be from "the Punjab," and there is accordingly nothing to prevent its having come from the Trans-Indus districts. If the owner could confirm this in the columns of the "*Field*," he would strengthen the evidence in favour of the distinctness of *O. v. blanfordi.*

As regards the third race of the species, namely, the true urial (*O. v. cycloceros*) of the Salt Range and other hills of the Cis-Indus districts of the Punjab, this appears to be a smaller and redder animal than either of the preceding, with the horns forming a very close spiral, and showing no tendency to turn out at the tips, while their front angles are not prominent, and the anterior one is often more or less rounded off.

Finally, we have the Kopet-Dagh urial (*O. v. arkal*), from the range dividing Persia and Turkestan, in which, as exemplified by a fine skull presented by Mr. St. George Littledale to the British Museum, the front surface of the horns is very broad and nearly flat, with but few transverse wrinkles, and very prominent front angles.

Any additional information, and more especially photographs, which would help to solve the urial question, would be acceptable.

R. L.

(*The above appeared in the "Field,"* 24*th December* 1904.)

No. XVIII.—ABNORMAL SAMBAR HEAD.

(*With a plate.*)

The stag whose head is shown in the accompanying sketch was shot in the Hoshangabad district, Central Provinces, near the Tawa River by A. G. Hendley, Major, Indian Medical Service, in the month of December 1900. The stag was a very large light-coloured stag, incisor teeth much worn and chipped, an indication of age. He was in good condition, was in company of several hinds, and had no injury to any of his organs. It will be seen that the horns have no brow antlers. The left horn divides into three spikes. The right horn also divides into three spikes, one being much smaller than the other two. At one time there had been a 4th spike to this horn near the shortest spike, but it had broken off, leaving a rough triangular mark at the point of fracture. The five longest spikes from burr to point varied in length from 21 inches to 29 inches, the shortest 11 inches. Width between tips 29 inches, girth of beam below division—right horn 10 inches, left horn 11 inches.

J. D. INVERARITY.

BOMBAY, *January*, 1905.

No. XIX.—THE GOOSANDER (*MERGANSER CASTOR*).

I am sending the following notes on the Goosander (*M. castor*) which, not being a very common duck, may be of some interest to readers of the Journal.

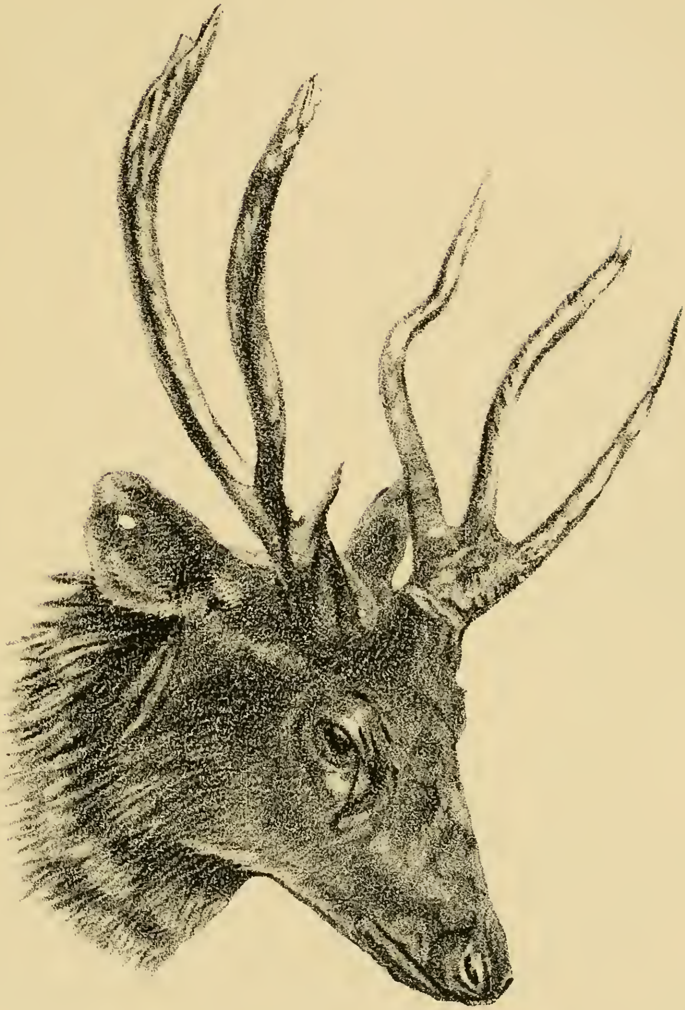
On the 19th instant, my collector brought me in 3 fine males of the Goosander, in most perfect plumage, which he told me he had shot on the Gadadhar river some five or six miles from this garden ; that, moreover, they were numerous and far from shy : so determining to find out the truth, I went myself on the 22nd and personally can fully confirm the correctness of the man's statement.

The Gadadhar is a fine stream rising, I believe, somewhere in the higher Bhutan Hills. At the point nearest this it is fairly swift, flowing over small rocks, pebbles, and sand, and now in the cold weather the water it contains is beautifully clear and icy cold. Wherever there are shallows it forms into small rapids ; these the Goosander especially seems to frequent, though it may also be seen in the broader parts as well. The banks are sandy and more or less thinly wooded, but the chief jungle is grass, null and ekra.

The birds are found in parties of 5 to 20, the males keeping as a rule quite apart from the females, and except when much disturbed by firing do not get mixed up with them.

The drake is most conspicuous, his handsome black and white plumage showing up at a distance ; he swims high, and early in the day may be seen actively diving through and about the rapids, occasionally standing up in the water stretching his neck and flapping his wings.

The female owing to its smaller size and the general slaty colour of its plumage seems to sit much lower on the water and is also shyer than the male though I may remark neither bird will readily allow one to get within



ABNORMAL HEAD OF SAMBER

Shot by Major A. G. HENDLEY, I. M. S. Dec. 1900.

CORTEZ & CO. LITH. BOMBAY.

gunshot from the bank. One female shot contained about 8 or 10 small fish 2″ to 3″ in length. Both birds on this part of the river are really far from shy, but this is not surprising, being practically in Cooch Behar where I am told game is preserved and every other native does *not* carry a gun. Even the Ruddy Sheldrake, that cutest of birds, will here allow a fairly near approach in a native boat if one only talks, and does not pretend to be more than the ordinary boat load of people that they are so accustomed to see passing up and down the river all day and every day. The same holds good with regard to the Goosander, which will allow one to get within 25 or 30 yards, and even then may be seen with head or bills resting on their backs or preening themselves (this during the heat of the day); a nearer approach sets them swimming as a rule up stream; any peculiar silence in the boat or an attempt to stop or turn directly towards them, puts them at once on the wing. Skittering along the water for some little distance and then flying low over it, 6 or 8 feet, perhaps less, they will, if not fired at, alight again at the next rapid or broken water. Their flight is, to me, strong and noisy, the whistling of their wings being distinctly heard as they approach the boat. They will not, I notice, pass directly over a boat, but pass to either side at a distance of about 20 or 25 yards, merely rising a very little.

Cripples swim down stream, the current seeming too strong for badly winged birds to make much headway against; when hard pressed their diving is rapid and constant, varied by rapid rushes along the surface, they go under at the proverbial " flash," and it is surprising the time they keep down and, helped by the current, the distance they travel.

I have not been brave enough to try the flesh, but my Sonthal servants and a Christian Baboo, however, have; the former say that the Cormorant is preferable, the latter that he succeeded in making the 2nd bird I gave quite nice—" no fishy '—by cooking it with lime (chunam) and many other strange and wonderful ingredients.

The name amongst the Bengalies on the Gadadhar for this duck is " *Pattee hans.*" I do not know if they apply this to any other species besides, but give it for what it is worth, as few vernacular names for this bird seem to be known.

All the specimens I have got are fully adult birds in perfect plumage.

A. M. PRIMROSE.

MORNAI TEA ESTATE, TAMARHAK P.O.
GAURIPUR, ASSAM,
25th January, 1905.

No. XX.—TROUT AND OTHER FISH AND FISHING IN CEYLON.

In the *Fishing Gazette* of November 5, I suggested that it would be very interesting to know how our friends in Ceylon were getting on with their trout stocking and preserving efforts. In reply to this Mr. R. A. G. Festing, one of the members of the Ceylon Fishing Club, very kindly sends me the following particulars. I see from the rules that the good standard of 11in. is fixed as the limit below which trout must not be retained —R. B. M.

DEAR SIR,—In your editorial notes in the *Fishing Gazette* of Nov. 5 you ask for information about trout breeding in Ceylon. The following lines may be of some interest to readers of your paper.

The first experiments in trout breeding were made in 1880 by the late Mr. H. L. Hubbard. In 1882 a few fish were turned into the stream at Nuwara Eliya, and ova have been more or less regularly imported since 1886. When the Ceylon Fishing Club was started I do not know. At first the ova of brown trout and Loch Levens only were imported; but in 1889 the ova of rainbow trout were introduced. The experiment proved successful, the rainbows taking kindly to the Ceylon streams, and they are now far more popular than the brown trout on account of their superior sporting and edible qualities.

The fish imported have thrived well, and now run to a large size. I do not know what the record size is, but Mr. Plate's big rainbow trout mentioned in your paper about a year ago (I could not find the reference) is probably one of the biggest. Fish up to 3lb. are fairly common. The average of takable fish is a little over a pound—at least, that is my experience, but more expert anglers may have a much better average.

Spasmodic attempts have been made in the past to breed fish artificially from the imported stock; but the difficulty has been to find males in milt when the females are ripe. No attempt, I believe, to breed fish artificially has so far been a success. A few years ago the trout started breeding naturally. Whether these naturally bred fish are pure rainbows or hybrids I do not know. But with the fish now breeding naturally there should be no difficulty in stocking all the likely up-country streams, and it is possible that the Ceylon Fishing Club may in a few years be in a position to supply India with ova or fry. With this end in view the club has lately been considering the question of getting out an expert from home to build hatcheries and instruct them how to breed trout.

As to the streams—they are all fine trout streams with plenty of natural food and plenty of good running water. There is no danger of the carp fouling the water as suggested by you. The carp keep to the lakes and lower portions of the Nuwara Eliya streams. They do not wander far from the slack water.

The Horton Plains stream, which is the finest bit of stocked water here, is an ideal trout stream, combining all the best qualities of English trout streams, except a regular rise of fly. At its head it is a very small stream with deep holes and good "elbows" thickly fringed with rhododendron bushes. One has to throw a fly very accurately to drop it into these pools. There are good gravelly shallows in the tributary streams which should make excellent spawning beds. As the stream increases in volume there are deep rocky pools, big enough to hold salmon, long stretches of slack deep water, enticing stickles and some fine waterfalls—in fact, every sort of water to tempt the trout. And in addition to this, the stream flows through glorious country. No description that I can write would ever do justice to it. To give a rough general idea—imagine Exmoor from six to seven thousand feet above sea level with "patana" grass instead of heather. I wish I had some photographs to send you, but all mine are stuck in my book.

The two small streams at Nuwara Eliya flow into lakes, the outlets from which are practically blocked against fish attempting to descend. The Horton Plains and Ambawella streams end, so far as trout fishing is concerned, abruptly as huge waterfalls, down which no fish is likely to descend voluntarily. This, I think, accounts for the fact that rainbow trout have been so successful in these streams. They cannot escape, as they have done from so many English waters in which they have been tried.

In the streams fly only is allowed, a No. 6 hook, Redditch scale, being the largest size permissible. A No. 6 hook is a large one, and permits small salmon flies being used. This may seem like " poaching " to some people, and perhaps the size might with advantage be reduced. But it must be remembered that the fish are not free risers. There is too much bottom food and not enough surface food. And in the big pools a small fly passes unnoticed a long way above the fishes' heads. For brown trout I have found a good sized March Brown do as well as anything. The rainbows undoubtedly prefer something brighter, and few flies are better than a very small Silver Doctor ; and though other fishermen may prefer other flies, I would always take these two with me, whatever the condition of the water. In the lakes artificial spinning bait is allowed, but the weeds are a nuisance, and I have not often attempted spinning, and have only once succeeded in landing a fish on a Devon minnow in Lake Gregory.

As to rods, everyone naturally suits his own fancy ; but a small rod is, in my opinion, essential for the small streams. I have an 8½ft., 3¾oz., cane rod, by Foster, which is an ideal weapon. It will throw a very accurate fly, and I have landed fish of about 2¾lb. on it. A larger rod is wanted for the bigger waters where a long cast is necessary.

The chief enemies with which the fish have to contend are otters, kingfishers, big cannibal trout, and poachers. Of otters I have seen any number while fishing. It is contended by some that the otter really does no harm, that he captures only the big sluggish cannibal, who well deserves his fate. This may or may not be true, but otters do undoubtedly disturb the water, even if they do not catch the smaller and livelier fish. I have seen rising trout most effectually " put down" by an otter swimming through the pool, and nothing would persuade them to rise for the rest of the day. In waters such as these where the fish are not free risers, anything that discourages them from rising, should be eliminated.

In concluding these notes on Ceylon trout, I wish to remark that my experience of them is very small compared with that of those favoured beings who live near the streams. A week or ten days' holiday snatched once and again from a reluctant Government, and a three months' sojourn at Nuwara Eliya, is all the time that I have had to become acquainted with these fish. Perhaps others, much better qualified than myself to write about the subject, may send you an account of Ceylon trout. In which case this screed need never appear in print. But in case none of your subscribers from this island comes forward to answer your appeal, these notes are offered for what they are worth.

But besides trout, which are restricted to a certain altitude in the hill country, there is good fishing to be had in the low country of Ceylon, in river, lagoon, sea and tank; and it may not be out of place to offer a few remarks on some of the fish that the writer has caught.

Very little is known from an angler's point of view, about lagoon and tank fishing in Ceylon. There are a few enthusiasts to be met occasionally who will speak of great captures; but we badly want a second Thomas, not only to show us how to catch the fish, but to tell us what fish there are worth catching. Until I came to this district, about two years ago, I was quite unaware of the splendid opportunities for sport with rod and line in the low country, and I believe many other keen anglers here are similarly ignorant. I therefore offer these remarks with less diffidence than they otherwise deserve, only hoping that brother anglers may come forward and contribute their quota of experience to the pages of the *Fishing Gazette*.

The most common of low country fish is the Singhalese "lula"—the Indian "murral." The Tamils call him "viral." His classical name is *Ophiocephalus striatus*. He is to be found in nearly all tanks and rivers that do not run dry; but he will live a long time without water apparently. A tank near here was completely dry for a month or six weeks last year. When the rain came and the fields were being irrigated, I was shooting snipe, and picked up several fair-sized lula in the padi field below the tank. They had evidently been washed through the sluice of the tank; but where they came from is a mystery, for the tank in question is not fed by any river. They must have been lying up under the grass and mud along the edge of the tank "bund."

Thomas, in his "Rod in India" (2nd edition), treats the lula, or murral, with scant ceremony. He regards him as a poor sort of pike to be captured with frogs and similar bait. But the lula is really a gentleman to be regarded with respect, for he rises to the fly freely and is a good table fish in spite of his bones—two supreme qualities. He does not fight very hard—about as well as a chub perhaps—but he often leaps clear of the water as soon as he feels the hook. A clear, calm day with water low is the best time for taking him with a fly. He is just the opposite of the trout in this respect. I have seldom caught them when there has been any wind or when the water was high. He will take a dry fly—if you are a dry fly purist—but the best ones I have caught have been taken with a large Red Palmer fished wet. There is a small red Dragon Fly on which the lula feeds in the evenings, and then the Red Palmer or Foster's "Caterpillar" will do great execution.

The lula is said to run to 3ft. in length. The largest I ever saw was about 5lb. or 6lb., which was taken by a native in a wicker-basket trap. The natives here also catch good ones with a live bait and float on a hand-line. Or when the water is low they "drive" them into nets staked across a narrow opening in tank or river. The largest I have caught with a fly was just 3lb. I got three fish one evening weighing 8¼lb. Doubtless larger ones might be caught with a frog, but who would use bait so long as fish were to be caught with the fly? Strong tackle is necessary, as one drops one's fly into a hole between the weeds, and if Mr. Lula takes it, it is a case of "Pull devil, pull baker"—to haul him safe into a more open spot.

There are many other tank fish, but I have not caught any that rose so freely to fly or was such good eating as the lula; and these notes are already becoming too long. I will just mention a species of carp which I have caught with fly in tanks here up to nearly ½lb. I think this fish is the Olive Carp, or *Barbus chrysopoma.* He corresponds as nearly as possible with Thomas' picture and description of this fish.

Of lagoon fish in this district the most common is the "koduva" (Tamil). His classical name is *Lates calcarifer.* A right handsome fish he is with his deep shoulder, prominent back fin, sheeny body and brilliant eye. But he is not so good as he looks. I have heard his flesh described as a mixture of cotton-wool, mud, and needles—not exactly a "table" fish! but the natives dry him and eat him. He runs to a huge size—how large I am afraid to say. I have seen him caught with a live bait on hand-lines well over 30lb., and I have caught them myself with spoon and spinning bait over 20lb., and hooked one monster that—but that is another story.

He cannot be said to be lively in his play. He is a sulky, dogged brute, but very strong. He takes out line slowly but surely, and woe-betide your tackle if you try to stop a big one too quickly! I hooked a good one once on a brand-new line that was absolutely sound. He "towed" away about 100 yards, when I thought he had gone far enough and put the pressure on. The fish thought differently, and we parted company, the running line breaking. I tested the line when I got home and found it would stand a dead strain of 14½lb. This will give you some notion of their power.

The koduva takes the bait very quietly. Often you feel nothing at all, and find your line being slowly taken out as you try to reel in. In my experience, the only way is to let the fish go and follow him as best you can—in a boat if one is available. Disaster has always been the result of my trying to check them. How far they will go with their slow "towing" pull I don't know. A writer in Thomas' book mentions having followed a huge one for 400 yards, but I doubt if this was all in one stretch without any occasional pause.

Many are the stories the writer could tell of brave fights with this and other lagoon monsters—how, for example, an enthusiastic brother angler hooked a "big 'un" at dusk which kept him busy all night, and how, in the small hours of the morning, the haggard, weary-eyed angler was still holding on to his giant fish and was shouting for the gaff as the fish at last showed signs of yielding. I draw a veil over the closing scene. The fish turned out to be a young crocodile !

Another fine lagoon fish is the " kalai." I have not been able to identify him. I thought at first he was the same as the Bamin or Paumben salmon, but on referring to Thomas I find he is not. He does not run so large as the koduva ; but he is a far finer fighter. Weight for weight he will play as well as a salmon. He is to be caught in the same way as a koduva, with live bait, natural spinning bait or spoon. But the strongest tackle and hooks are necessary.

Lastly, I would mention the " seer. " He is properly a sea fish, but comes into creeks and estuaries occasionally. He will take a fly or spoon, is excellent eating, and fights to the last ounce of his strength. But my experience of rod fishing for these fish is very small. I have only caught two or three on a fly in Galle Harbour.

I have caught several other kinds of fish, and there are probably many others unknown to me which are well worth catching, but these remarks will show, I hope, that good fishing is to be got in the low country of Ceylon, and I would advise any keen angler about to visit the country to bring a fly and spinning rod and suitable tackle.

I have given no details as to the class of rods, lines and tackles most suitable to this low country for fear of trespassing on your patience, which I fear I have overtaxed already, but if anyone requires any particulars I shall be very glad to give him any information I can through the *Fishing Gazette.*

R. A. G. Festing.

(*The above appeared in the " Fishing Gazette,"* 7*th January* 1905.)

No. XXI.—BIG GAME.

ON THE BREEDING SEASONS AND OTHER MATTERS.

In the last issue of this Journal some notes regarding the breeding season of mammals, with particular reference to big game, were published. It is complained with much truth that our knowledge on this point is very limited, while the complaint is also made of the vagueness of such information as exists regarding the subject under review. We are told that in Blanford's *Mammals of India* the statement is often repeated that " the breeding time of a particular species is ' about ' such and such a month. " Is it possible, however, to be more explicit ? My own experience indicates that the breeding season of many animals is so variable, or is spread over so considerable a period, that more exact statements are likely to be erroneous. Can any one say that the tiger, for instance, has a breeding season that can be confined within the limits of one month ? I think not, for cubs of the same age may be found at different periods of the year. My own experience of these animals has unfortunately been confined to the months of March, April, and May. But I have found them during those months to have cubs varying between a few days (on April 11th), three or four months (on 7th May), and six months of age (in March). I recollect instances of young cubs, two or three weeks old, being caught in May, in July, and in December.

I have seldom found tigers in pairs, but, as already mentioned, my experience has been confined to the hot weather. In one case I found tracks of a tiger, day after day for some time, with which were a tigress and a large cub—perhaps nearly a year old. The tiger, a large one, was going lame on one hind leg, which made a track like that of a plantigrade animal. Tracking these animals, I kicked open a dry dropping, and found it full of tiger's hair whilst it also contained a good-sized tiger-claw. Presumably another of the species had fallen a victim to the big tiger, which had been injured in the hind leg in the encounter. I have heard of several similar instances of cannibalistic propensities on the part of the great felines.

Out of forty tigers which I brought to bag, there were only five pairs, whilst in one other case two out of a family of three were shot. The remaining twenty-eight were single animals. Perhaps they reside more in pairs at other seasons of the year. In two instances the pairs were young animals of perhaps three years of age, and in one case a very old pair with faded coats and worn canines were said, by the inhabitants of the hamlet near which they were killed, to have lived together for many years.

It is generally said that there are more females than males of this species. In my experience the males preponderate, and out of forty only fourteen were tigresses. None of these had unborn cubs in them.

As with tigers, so in the case of panthers I have comparatively seldom found pairs, and have shot more males than females. I have had in my possession on two occasions young cubs born in the month of December ; another cub, shot in March, was probably born in December also.

The last panther I saw—which, by the way, nearly killed me—was found to contain four unborn cubs which would probably have been produced in about a fortnight. This was in the middle of March.

Bears also appear to have young at uncertain periods. In April 1889 a brown bear cub (*Ursus isabellinus*) about 3 weeks old was caught, and another about the same age which I found in the Tilail Valley of Kashmir on the 26th May. On the 30th May I came upon an old bear with two well-grown cubs, which I judged to be about six months old. But could they have been born during hibernation? On 4th June, 1890, I shot a black bear (*Ursus labiatus*) in the Satpuras with a cub three or four weeks old. On 25th April, 1894, I killed a black bear with two cubs which could not have been less than six months of age. In February, 1897, we caught two cubs a few weeks old, still riding pick-aback on the mother, and next day we saw two more about six months old.

It is frequently stated that tigers invariably commence eating their prey at the haunch, and panthers at the stomach. Certainly I have never known tigers begin at any other portion of the body, but panthers not infrequently commence at the haunch also. The last panther I encountered had bitten the tail off a large buffalo that he had killed, and had eaten a portion of the hind quarters. Occasionally one comes across strange happenings with regard to animals tied up. On one occasion a goat tied up for a panther was killed by a porcupine, perhaps by accidental collision. A friend of mine found one of his buffaloes gored to death by a bison, the ground all round being trampled by the enraged wild beast.

Since writing these notes I have received the Journal for June, 1904, where I find several interesting questions discussed concerning big game. There is nothing new in Colonel Stewart's note regarding the original home of the tiger. I think it is generally accepted that the tiger is an immigrant into India from northern regions. The animal's impatience of the heat of the sun in southern latitudes, and habit of lying immersed in water in the heat of the day—the only feline addicted to this— point to a northern origin. At the same time it may be doubted if the southerly immigration of the tiger has taken place as recently as Colonel Stewart appears to indicate. Tigers abound in Java and Sumatra, and must have presumably got there before those islands became separated from the mainland. This may have been within recent geological but not historical times. Another contributor writes on "Tiger *versus* Bear," and asks if there are other instances on record of encounters between these animals, of which he cites an example. I do not think such combats are uncommon, and a tiger should have little difficulty in disposing of the small Malay bear, when he is able to kill and devour the much more formidable black bear of the Indian plains. Sanderson, in his "*Thirteen years among the wild beasts of India*," tells us of a tiger which was in the habit of preying on the hapless bruin in preference to other game. In the Melghat Forest, North Berar, in 1890, the skin of a bear was brought to me, quite fresh, with many holes in it inflicted by a tiger. The villagers said there had been a prolonged combat between the two animals, and the bear managed to get away, but so badly wounded that it was easily disposed of by the inhabitants who had been attracted to the spot by the roarings and howlings of the combatants. In 1896 I found on the top of a hill near Fort Mahor, Hyderabad, the remains of two bears which had been killed and devoured by a pair of tigers. Tigers will resort to strange diet when hard put to it, and the hairy pelt of a bear must be difficult to digest. I have found the remains of crabs and once of a large python eaten by a tiger, and one frequently finds porcupine quills embedded in the paws. One large tiger I shot had several suppurating sores on the back of the neck from which porcupine quills were extracted. This looked as if he had been rolling on his victim, although my shikaris would have it that the porcupine had shot the quills at his enemy, like arrows from a bow !

R. G. BURTON, MAJOR,
94th Russell's Infantry.

POONA, *February 9th*, 1905.

No. XXII.—DOUBLE-HEADED SNAKES.

No doubt everyone in India is familiar with the so-called double-headed snakes which many jugglers include among their stock in trade. The snakes exhibited as such by this fraternity are usually the earth snakes, creatures remarkable among their kind for the bluntness of their tails, a condition which lends itself peculiarly well to the artifices of these people, who mutilate or otherwise modify them so as to make them resemble the head. The snake usually selected for this purpose, both on account of its abundance and size, is John's Earth Snake (*Eryx johnii*).

It is perhaps not so well-known that genuine double-headed snakes do occur occasionally as freaks, but in these instances both heads are always attached to the anterior extremity of the body constituting what is technically called anterior dichotomy.

Dichotomy (Greek *dicha* in two parts, *temno* I cut) arises from a cleavage of one or other pole of the developing embryo, and may occur anteriorly or posteriorly. It may be partial when the reduplicated heads, sterns, or bodies remain more or less attached to one another, or complete when two separate organisms are derived, so that this phenomenon accounts for one method by which twins are produced. There are abundant examples of monstrosities in man and the lower animals formed by this process to be found in various museums, and it is therefore not surprising that the same abnormality occurs occasionally in snakes.

I have just had an opportunity of examining a young specimen of the common *Lycodon aulicus* exhibiting this anomaly, which I found on the shelves of the Fyzabad Museum. This specimen has the head and neck reduplicated, and a reference to my notebook shows that all the records of this peculiarity I have been able to collect from various sources, are examples of anterior dichotomy. I have never heard of an example of posterior dichotomy in snakes, though the condition doubtless occurs, and has been observed in frogs and other reptiles. This Fyzabad specimen, which measures a shade over 5½ inches, is evidently a hatchling. The dual nature of the head and neck is very evident to sight and touch for $\frac{7}{8}$ of an inch. The reduplicated parts are placed side by side, and are connected by a web except for $\frac{1}{5}$ of an inch where the snouts are quite free. The web commences opposite the 8th supralabial shields, and is placed rather nearer the ventral aspect, so that the chins are approximated. At the point where the two necks blend, is a pronounced rounded dorsal prominence. The size and sodden condition of the specimen render the detail of the scale characters somewhat difficult to determine with accuracy; however, I have made the following observations:—The præocular touches the frontal shield on the right side of the left head only. The rows of scales anterior to the dorsal prominence, *i.e.*, over the cleft part of the body, are variable, but number about 27; behind this they are the normal 17. There are 189 ventrals, those beneath the bifurcated parts are not double, but extend completely across both trunks. The navel implicates the 167th and 168th shields so that 21 intervene between it and the anal shield, which is divided. The subcaudals are 62. In other respects the scales and shields are normal.

The following from my notebook may add to the interest of this note.

Buckland in his "Curiosities of Natural History" (p. 177) says there are two specimens of snakes with two heads on one body in the Royal College of Surgeons' Museum, London, and one of these he identified as *Coluber natrix* (now *Tropidonotus natrix*), the common grass snake found in England.

In the Journal of the Linnean Society for 1868 is mentioned a sea-snake, *Hydrophis sublævis* (now *H. cyanocinctus*) caught near Madras, with two heads.

Nicholson in his book "Indian Snakes" (p. 22) mentions a young two-headed *Tropidonotus quincunciatus* (now *T. piscator*) in the Madras Museum, and says "this monstrosity is apparently rather common amongst the sea-snakes" and further remarks : "they do not, however, appear to survive their birth long, the specimens to be found in museums being of small size." That these freaks are as common as Nicholson remarks, I am inclined to doubt, and Mr. Phipson in a letter to me, dated 2nd February 1905, says : "I have been collecting snakes in this country for the last 26 years, and have examined thousands of sea-snakes in the fishermen's nets here, but I have never seen an instance of this form of teratology." The specimen I have described in this note is the only one of many hundreds of snakes I have examined in the fresh state and in museums which was so distinguished.

In "*The Field*" for 31st October, 1903, a Mr. Fulton writes as follows :—"Some time ago when in Australia I was one day helping the men on a sheep station to collect wood previous to the shearing season. In cutting up some old timber we came across an old snake with several young ones. One of these had two perfect heads on, so I secured it, and brought it home."

S. S. Flower in the P. Z. S., 1899, p. 677, mentions a water snake, *Homalopsis buccata*, in the Siamese Museum, with "two heads, side by side, each about equally perfectly developed."

In the *Madras Times* for 13th January, 1897, a specimen of a two-headed snake is mentioned in the possession of a Mr. E. C. Fischer, of New York City, then in Madras. It was identified as an American hog-nosed snake *Heterodon simus* and was about a foot long, and over four months old.

The following remarks were made :—"The snake lives in a glass box, and feeds with both heads simultaneously on milk, raw meat, and blood. Mr. Fischer finds it best to feed both heads at once, for strange to say, they appear to be jealous of each other, and sometimes fight ; at other times they play with one another. The animal seems to know Mr. Fischer, for it comes to the side of its box, and welcomes him by protruding its tongues in sign of joy. A photograph of the snake was recently given in the *Scientific American.*

FYZABAD, *1st February*, 1905. F. WALL, CAPTAIN, I.M.S., C.M.Z.S.

No. XXIII.—WINTER PLUMAGE OF THE MALE BENGAL FLORICAN (*SYPHEOTIS BENGALENSIS*).

There appears to be some doubt about the male winter plumage of the Bengal Florican, since some of our best ornithologists are at variance on this point.

The most recent work I have access to is Oates' "Game Birds of India." In part I, p. 418, this author describes the male in winter plumage, and the female at all seasons as similar, entirely ignoring the observations of earlier writers many of whom show that some males at least are attired in a modified nuptial garb. Blanford, in "The Fauna of British India"—Birds., Vol. IV, p. 200, begins: "*Coloration. Female* (and, according to some, male in winter plumage)", evidently holding an opinion different from that expressed by Oates. He then describes the male in breeding plumage, and remarks later: "The black plumage of the male is acquired by a moult, and is retained partly or wholly by some birds in the winter; but in others, probably younger, it appears to be replaced by the ordinary garb of the female" and quotes Blyth as having witnessed this latter change in birds kept in confinement. Hume and Marshall in "The Game Birds of India, Burmah and Ceylon," Vol. 1, pp. 24 and 25, say: "Young males, up to the beginning of March, entirely resemble the females, but the moult then commencing gradually assimilates them to the adults, which never lose, . . . the striking black and white garb that . . . is proper to the male sex." Later on this remark appears to me to be contradicted by the following:—"Two young but full grown, or nearly full grown, males before me, shot in January, have the black bodies and white wings of the adult, but the heads and necks are like those of the females."

I have just had an opportunity of examining a pair of these birds shot in the Kheri District, Oudh, on January 31st, 1905. The female needs no remarks, but the male, very dissimilar in its livery, nearly agrees with the two males just quoted from Hume and Marshall. I made the following observations. ♂ Length 27½", wing 13¼", tarsus 5½."

Plumage, except the wing and under parts, as in the female. The 1st quill is blackish brown with whitish fulvous mottling in bars on the inner web. The 2nd quill deep black at tip and on the outer web, pure white on inner web. 3rd, 4th, 5th and 6th quills pure white tipped black. The 7th and 8th quills blackish-brown beautifully marbled in whitish bars. The 9th and 10th quills pure white with black tips. All shafts black throughout.

The secondaries are pure white except the basal ¾—⅘th of the shafts which are black, and the inner webs which are progressively increasingly black from without inwards from their bases, the whole web being black in the innermost three.

The upper coverts are white mottled fulvous, the 7th and 8th greater coverts coloured like the corresponding quills. The lower plumage, including that on the thighs, is black up to the lower part of the breast, except the greater primary coverts which are pure white basally. The measurements of the female are—Length 29½", wing 14", tarsus 6".

F. WALL, C.M.Z.S.,
CAPTAIN, I.M.S.

FYZABAD, *February 5th*, 1905.

No. XXIV.—NOTES ON SOME BANGALORE SNAKES.

A two months' holiday in Bangalore during August and September, 1904, furnished me with the following notes on some species common in that locality:—

Tropidonotus piscator.—The Canarese name for this species is *neer hāvu* which equals "water-snake." I witnessed one instance of the extreme ferocity of this notably fierce snake. Two *sampwallahs* had a specimen, among others, which they displayed for my benefit. This specimen fastened itself on to the great toe of one man who was sitting tailor-fashion, and it was only by prizing open the creature's mouth with considerable force that it could be made to release its hold, and almost at once it fastened itself again on to the man's leg, requiring a repetition of the same violent measures. Blood oozed fairly freely from both wounds.

Tropidonotus stolatus.—A small one measuring 7½″ was brought to me on the 29th of September.

Macropisthodon plumbicolor.—The "*hãssaru hãvu*" or "green snake" of the Canarese.

This is evidently a very common snake about Bangalore, though Nicholson does not mention it as such in his list on page 175 of "Indian Snakes." It is as timid and gentle as the next species, allowing itself to be freely handled at all times. Like the next species, too, it flattens itself under excitement. One I had in captivity for some months fed voraciously on frogs. The eggs evidently hatch about August and September as will be seen from the following list. The two specimens mentioned under the date 29th of October were found together and were, therefore, probably just hatched from the same clutch of eggs.

Date.	Sex.	Length.	Tail.	Ventrals.	Sub-caudals.	Loreal.	Præoculars.	Scales.			Remarks.
								2 heads lengths behind head.	Midbody.	2 heads lengths before vent.	
Aug. 29th	?	6″	$\frac{7}{8}$″	153	43	0	2	23	25	19	2 postoculars on left side. 15 ventrals between navel and anal shield.
,,	?	6¼″	$\frac{13}{16}$″	157	37	1(R)	2	23	23	17	18 ventrals between navel and anal shields. Last 3 subcaudals entire.
Sep. 2.	?	5⅜″	¾″	...	...	...	...	...	...		Mutilated.
9th	♀	6⅞″	$\frac{15}{16}$″	156	42	0	2	23	25	19	16 ventrals between navel and anal. Died 16th February 1905. 12 follicles enlarged.
10th	♀	2′0½″	3$\frac{11}{16}$″	153	41	1	2	21	23	16	⅓″×⅙″—4. Postoculars on right side.
16th	...	Adult	...	152	?	0	2	23	23	17	A slough found emerging from hole in bathroom.
?	...	...	...	149	42	1	2	25	25	19	Hatchling with no date in private collection.
?	♀	...	...	153	34	0	2	23	25	17	An adult in Bangalore Museum.

The posterior sublinguals touch 3 infralabials 4th, 5th and 6th, or 5th, 6th and 7th. The 6th or 7th of the infralabial series constitutes the *pentagonal* which is broader than the posterior sublinguals, and in contact with 3 scales posteriorly. Keels in both sexes are present in all rows of scales, to the tip of the tail, excepting the ultimate row for a variable extent in the forepart of the body.

Helicops schistosus.—This is evidently a very common snake in this locality, as every *sampwallah* had some, and could procure them in numbers to order. The rule that the females in snakes are larger than the males, is certainly exemplified in this species. It is of a very inoffensive disposition, never attempting to bite, though some of my specimens had ample provocation. At one spot in the Hotel garden the grass beneath some trees was long, and all my specimens when liberated invariably made for this patch about 10 to 15 yards distant. No matter how often they were brought back into the open, they repeated their endeavours, and though frustrated, never tried to bite me when effecting their recapture. They would glide under or over such obstacles as a handkerchief placed and flourished in their way, or through or over my feet, in preference to taking a more circuitous direction to avoid them. In motion they slightly erect the head, and move briskly and fast. When alarmed they erect the head, and flatten the body down to the vent, to a very remarkable degree, far more so than any other snake I know. This flattening is more evident in the females, and I witnessed it most often when they were disturbed in opening their box. At liberty they behave similarly, but they strive to escape so hurriedly that one has not the same opportunity of observing this peculiarity. The eye is rotated more actively, and to a degree I have never witnessed in other species, and to this it owes its very appropriate generic name *Helicops* (Gk. *Helikos*=rolling, *ops* eye). Though so common the *sampwallahs* had no vernacular name for it. They all told me it frequented the bamboos in the Lal Bagh, and many of the specimens were caught on the bamboo vegetation some feet from the ground. They denied its frequenting water, which surprised me, for the high-placed, slit-like nostrils proclaim its aquatic tastes.

Three specimens were brought to me on the 27th August—2 males and 1 female ; all were captured lying on the same bamboo stem about 10 feet from the ground. Two of these were observed to be "in copula" at about 5 p.m. on the 26th, and a futile attempt at capture made, which was not pressed, the men fearing that the pair might disengage, and jeopardise their chance of obtaining my reward of five rupees. Another and a successful attempt was made on the morning of the 27th, and strange to say the snakes were produced from a cloth at about 11 a.m. still united. I carefully investigated the conjunction on several occasions, being favoured by the docile nature of the species, and their lengthy union, which lasted, without intermission (so far as I am aware), until some time after 12-30 p.m. on the 28th idem.

Subsequent to this no repetition of the act was witnessed. During the time I had them under observation (25½ hours) the left clasper of the male, and this only was engaged with the right orifice of the female, and this leads one to speculate whether, as certainly appears physically possible, two males may sometimes serve one female or *vice versa.* If disturbed, beyond the flattening of the body already referred to and the spasmodic protrusions of the tongue, no alarm was displayed, and no malice offered. Both parties were equally undemonstrative rarely evincing any movement, and then only altering their position somewhat; they did not lie coiled in one another's embraces, nor wreath their tails round one another as I have heard related of other snakes under similar conditions. The ventral apposition was so limited that nobody looking at them would have suspected their sexual relationship. The male was killed on the 2nd September, but the female survived until the 23rd of January 1905. Upon investigation 11 follicles in one ovary and 7 in the other were slightly larger ($\frac{1}{5}$ inch long), and more opaque and yellow than the rest. During the whole of her incarceration she refused all food, and the impaired vitality consequent upon this, augmented by the colder climate of Fyzabad, probably occasioned the arrest of normal developments, and it will be observed that in the female specimen of the last species, which had been in captivity since the 10th of September and died on the 16th February, follicles were evidently impregnated, but their development similarly interfered with. No male snake had been in company with this specimen within the above dates.

The following scale characteristics have escaped notice, or not met with the attention they deserve. The *lower temporal* shield touches 3 supralabials, *viz.*, the 6th, 7th and 8th. The *posterior sublinguals* touch three infralabials, *viz.*, the 5th, 6th and 7th, as in most of the genus *Tropidonotus.* The 7th of the infralabial series is the *pentagonal* and is broader than the posterior sublinguals, and in contact with 3 scales behind, as in most *Tropidonoti.* The *scales* anteriorly number 19, midbody 19 or 17, and posteriorly 17. The step where the reduction takes place occurs very near the middle of the body, sometimes before, but more often after this point. The reduction is effected by the absorption of the 4th row above the ventrals into the row above or below. I paid careful attention to the keels in the sexes, and could discover no accentuation of this condition in the male sex, confirming similar observations in many other species. The keels are absent in from 2—4 rows anteriorly (two heads-lengths behind the head), 2 rows in mid-body, and from 0-2 rows in the posterior body (2 heads-lengths in front of the vent), and cease in the median rows where the supracaudals number four. The red line running along the confines of the 5th and 6th rows above the ventrals (where the scales are 19) and the 4th and 5th rows (where the scales are 17) is much more conspicuous in the males.

The tongue is dull blue black.

The penis is studded with tentacles from base to tip.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	Scales.			Remarks.
						2 heads-lengths after head.	Midbody.	2 heads-lengths before vent.	
Aug.									
26th	♀	2′ 6½″	7⅛″	149	69	19	19	17	2 postoculars on right side. Died in captivity 14th January 1905.
27th	♀	2′ 6½″	6½″	148	64	19	19	17	Died in captivity 23rd January 1905.
27th	♂	1′ 9⅛″	6¼″	144	80	19	19	17	
27th	♂	1′ 11¾″	7″	142	77?	19	19·17	17	Tail incomplete.
28th	♀	1′ 9½″	4¾″	147	64	19	19·17	17	
28th	♂	1′ 4½″	4¾″	144	81	19	19	17	
28th	♂	1′ 3¾″	?	144	?	19	19	17	Tail incomplete.
Sept.									
4th	♀	2′ 3⅝″	5⅞″	148	65	19	17	17	Labials 8, the 4th touching the eye on left side occasioned by confluence of normal 4th and 5th. 5th infralabial subdivided both sides.
4th	♂	1′ 5¼″	5″	140	80	19	19·17	17	Internasal partially divided behind mesially.
4th	♀	1′ 9½″	5″	148	67	19	19	17	
4th	♂	1′ 8″	5⅞″	146	82	19	19	17	Internasal partially divided behind mesially.
4th	♂	1′ 9¾″	6½″	139	78	19	19	17	
4th	♂	1′ 11″	6¾″	143	79	19	19	17	

Zamenis mucosus.—A *sampwallah* on the 20th August brought one freshly caught, and about 5½ feet in length. This when liberated attacked his mongoose with great courage and determination, and inflicted a bite. When separated it compressed its neck, and uttered that peculiar scolding sound I have referred to in other notes in this Journal upon this snake. Another specimen was sent to me dead, and measured 7 feet 4½ inches. It was a male. I measured the slough of one in the Bangalore museum which had just been presented, and found it taped 9 feet 1½ inches, the tail being 2 feet 7½ inches. Though I have heard of larger specimens this is much the largest measurement of this species I have personally become acquainted with, and this allowing for considerable reduction for the stretching the slough undergoes. A native official in the museum told me this snake is eaten by the Tigala caste of Tamils, and he called a man of this caste employed in the garden. From him I elicited the following information. He told me the snake is called by them "*Jair* *potoo*" which I am informed is Canarese "jair" centipede, and "potoo" animal. (Rice in his work on Mysore, Vol. 1, p. 188, gives "kere" as a Canarese name for this species.) It is much esteemed by them as food, and is reputed of excellent benefit in the wasting of certain diseases. These people having skined and cleaned it, cut off about 4 inches from the head and about the same length in front of the vent. The rest is cut up into pieces, and cooked, the flesh resembling chicken in colour and taste.

The same man told me water snakes, cobras, and other poisonous snakes were disdained by his caste, and that none of the organs—bile, fat or other parts—entered into their dietary, or medicines.

Coluber helena.—A nice little specimen was brought to me alive on the 6th September which I killed on the 9th. Length 2′ 2⅞″, tail 6¼″. Ventrals 231, subcaudals 94. It was an active restless little creature, and when teased showed fight, by erecting and throwing its anterior body into broad sigmoid curves which it straightened in the act of striking. It struck out repeatedly, and in an upward direction much like *Zamenis mucosus.* Prior to striking when poised ready for action, the neck was markedly compressed, and at the same time the throat pouched and vertebral region correspondingly arched, exactly as in *Zamenis mucosus.* The skin between the scales was brought well into view, and was pinkish blue coloured, giving the reptile a very strikingly handsome appearance.

Dryophis mycterizans.—Called by the Canarese "*Hassru Muligay.*" It appears to be common, as all the *sampwallahs* had one or more on show. When poising preparatory to striking, the neck is much compressed, and at the same time the throat pouched, but there is no bowing of the vertebral region as in the last two snakes.

Date.	Sex.	Length.	Tail.	Ventrals.	Subcaudals.	SCALES.			REMARKS.
						2 heads-lengths after head.	Midbody.	2 heads-lengths before vent.	
Sept.									
5th	♀	...	...	179	146	15	15	11	The last ventral divided.
7th	♀	2′ 5¼″	10⅛″	185	158	15	15	11	Contained a frog (*Rana tigrina*).
23rd	♂	...	...	176	169	15	15	11	

F. WALL, C.M.Z.S.,
Captain, I.M.S.

FYZABAD, *17th February*, 1905.

No. XXV.—EGG-EATING COBRAS.

The interesting note of Mr. C. P. George's in the last Journal (page 174) with reference to the hatching of a guinea-fowl's egg after its recovery from a cobra's stomach, remarkable though it is, has an almost exact parallel which Miss Hopley in her work on snakes relates (page 60). She mentions a cobra being killed from which a hen's egg was extracted, marked, and placed under a guinea-fowl which in due course hatched out.

F. WALL, C.M.Z.S.,
CAPTAIN, I.M.S.

FYZABAD, 17*th February*, 1905.

PROCEEDINGS

OF THE MEETING HELD ON 22ND DECEMBER 1904.

A meeting of the members took place at the Society's rooms on 22nd December 1904, Major C. G. Nurse presiding.

NEW MEMBERS.

The election of the following new members since last meeting was duly announced :—

Life member : Meherban Piraji Rao Bapu Saheb Ghote, Chief of Kagal, senior (Kagal, S.M.C.). Members : Mr. A. D. S. Arbuthnot, R.E. (Bombay) ; Mr. L. Bagshawe (Bombay) ; Captain R. H. Griffith, R.F.A. (Kirkee) ; Mr. E. Wilson (Dehra Dun) ; Rev. P. G. Tibbs (Deolali) ; Mr. W. H. Ruddle (Secunderabad) ; Mr. R. W. D. Ashe, I.C.S. (Nellore, Madras Presidency) ; Mr. E. Pakenham-Walsh (I.C.S.), (Penukonda, Anantapur District).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's collection :—

Contribution.	Description.	Contributor.
1 Gadwall	*Chaulelasmus streperus* ...	Mr. A. Dunbar-Brander I.F.S.
1 Hobby........................	*Falco subbuteo* ...	...Mr. J. D. Inverarity.
1 Common Indian Nightjar (alive)........................	*Caprimulgus asiaticus*	...Mr. J. P. Chrystal.
1 Large Pin-tailed Sand-grouse........................	*Pteroclurus alchata*	H. H. the Maharaja of Bikanir.
1 Green-Shank	*Totanus glottis* ...	...H. H. the Maharaja of Bikanir.
1 Horsefields Nightjar	*Caprimulgus macrurus*	...Mr. R. G. Foster.
1 Barn-Owl (alive)	*Strix flammea* ...	..Rev. J. George, S.J.
1 Indian Koel (alive)	*Eudynamis honorata*	...Rev. J. George, S.J.
Some pearls and pearl shells from Coast of Cutch.......	....	H. H. the Rao Saheb of Cutch.
1 Snake........................	*Psammophis leithii* ...	...Capt. F. Wall, I.M.S.
1 Snake	*Lycodon striatus* ...	...Capt. F. Wall, I.M.S.
3 Snakes........................	*Typhlops braminus* ...	...Capt. F. Wall, I.M.S.

CONTRIBUTIONS TO THE LIBRARY.

These included 300 Zoological Records from 1896-97 and 1899 to 1902, from the Trustees of the British Museum.

PAPERS READ.

The following papers were then read and discussed :—" Shell-fish and their shapes," by E. Comber, F.Z.S. " Description of two new Snakes from Upper Burma," by G. A. Boulenger, F.R.S., V.P.Z.S. " Do wild animals ever die of intestinal obstruction ? " by Col. W. B. Bannerman, I.M.S. " Melanism in Black-Buck," by Major J. Manners Smith. " On fishes, from the Persian Gulf, the Sea of Oman, and Karachi, " collected by Mr. F. W. Townsend, by C. Tate Regan, B.A.

PROCEEDINGS

OF THE MEETING HELD ON THE 9TH FEBRUARY 1905.

A meeting of the members took place at the Society's rooms on the 9th February 1905, Mr. J. D. Inverarity presiding.

NEW MEMBERS.

The election of the following new members since last meeting was duly announced :—

Mr. R. C. Thompson (Bangkok, Siam); Mr. Hugh S. Gladstone (England); Mr. H. C. Aberholser (Washington) ; Mr. R. D. Bell, I.C.S., (Poona) ; H. H. the Sahebzada Nawab Mohammed Nasrulla Khan (Bhopal) ; Lieut. H. R. Watson (Secunderabad) ; Mr. E. S. Rindley, C.E., (Raipur) ; Mr. K. B. Williamson (Jubbulpore) ; Mr. S. W. Coxon (Damoh, C. P.) ; Major W. G. R. Cordue, R.E. (Bombay) ; Capt. L. Hulke (Ajmere) ; Mr. Hans Blascheck (Bombay) ; Mr. C. E. L. Gilbert (Dhulia).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged receipt of the following contributions since the last meeting : —

Contribution.	Description.	Contributor.
A collection of butterflies from N. Kanara.	………	Mr. T. R. D. Bell, I.F.S.
1 Comb Duck or Nukta ……	*Sarcidiornis melanonotus*..	Mr. W. F. L. Tottenham, I.F.S.
1 Black Partridge …………	*Francolinus vulgaris* …	Mr. R. H. Heath, C E.
5 Voles from Kashmir………	*Microtus brachelex* …	Col. A. E. Ward.
1 Vole from Ladak …… …..	*Microtus stracheyi*… …	Do.
1 Indian Crested Swift ……	*Macropteryx coronata* …	Mr. D. G. Hatchell.
1 Spotted Babbler …………	*Pellorneum ruficeps* …	Mr. R. B. Woosnam.
1 Nilgiri Babbler…………	*Alcippe phæocephala* …	Do.
1 Southern Red-whiskered Bulbul.	*Otocompsa fuscicaudata* …	Do.
1 Greenish Willow Warbler.	*Acanthopneuste viridanus*	Do.
1 Madras Tree-Shrew ………	*Tupaia ellioti* … …	Do.
1 Grey Musk Shrew…………	*Crocidura cærulea* …	Do.
3 Jungle Striped Squirrels…	*Sciurus tristriatus*… …	Do.
1 White-tailed Rat …………	*Mus blanfordi* … …	Do.
2 Brown Spiny Mice ………	*Mus platythrix* … …	Do.
8 Rats……………………	*Mus Sp.* … … …	Do.
1 Hammer-headed Oyster …	*Avicula vulgaris* … …	Mr. E. R. Jardine.
1 Snake (alive)………………	*Zamenis fasciolatus* …	Col. W. Bannerman, I.M.S.
1 Black-capped Kingfisher…	*Halcyon pileata* … …	Mr. P. R. Allen.
A number of Bird Skins……	…………	Mr. M. Mackenzie.
2 Chestnut Bitterns…………	*Ardetta cinnamomea* …	Mr. S. Armstrong.
1 White-tailed Lapwing……	*Chettusia leucura* … …	Do.
1 Screech-Owl ………………	*Strix flammea* … …	Mr. C. H. Donald.
1 Pale Harrier ………………	*Circus macrurus* … …	Do.
1 Indian Pitta ………………	*Pitta brachyura* … …	Do..
Skin of Fish-eating Crocodile from Sind.	*Gavialis gangeticus* …	H. E. Lord Lamington.
1 Crab-eating Mungoose……	*Herpestes urva* … …	Mr. H. Slade.
1 Tibet Marmot ……………	*Arctomys himalayanus* ..	Col. A. E. Ward.
1 Screech-owl (alive) ………	*Strix flammea* … …	Mr. Naranji Dwarkadas.

PAPERS READ.

The following papers were read and discussed :—1. Shells : (*b*) Their uses to Man, by E. Comber, F.Z.S. 2. King-Crows and Mynas as mess-mates, by D. Dewar, I.C.S. 3. Occurrence of the Scaup Duck (*Nyroca marila*) in Oudh, by Captain F. Wall, I.M.S., C.M.Z.S. 4. Egg-eating Cobras, by E. Brook-Fox. 5. Locusts. The Colouring of *Acridium peregrinum*, by Cecil E. C. Fischer, I.F.S. 6. The Habits of the Leaf Butterfly (Kallima), by E. Ernest Green, F.E.S. 7. The Breeding Seasons of Big Game in India, by A. H. A. Simcox, I.C.S. 8. Notes on the Houbara, by R. H. Heath, C.E.

EXHIBITS.

The following interesting exhibits were placed before the meeting by Mr. Comber, demonstrating some of the uses to which shells can be put :—

A number of dessert dishes, salt-cellars, spoons and ornaments, made from shells, lent by Messrs. Bhicajee and Co., Bombay.

Conch or Chank shell (*Turbinella rapa*) with brass mouth-piece, used in Hindu temples as a trumpet.

Giant Clams (*Tridacna gigas*) used as fonts in churches in France.

Cowries, used by Parsee Hat-makers for polishing cloth.

Cowries, used as money in India.

Bangles cut out of the Chank shell (*Turbinella rapa*).

An assortment of buttons, studs, paper knives, spoons, penholders, sleeve-links and knife handles.

3 Decorative panels of carved Mother-o'-pearl shell, lent by Messrs. Hinode, and Co., Bombay.

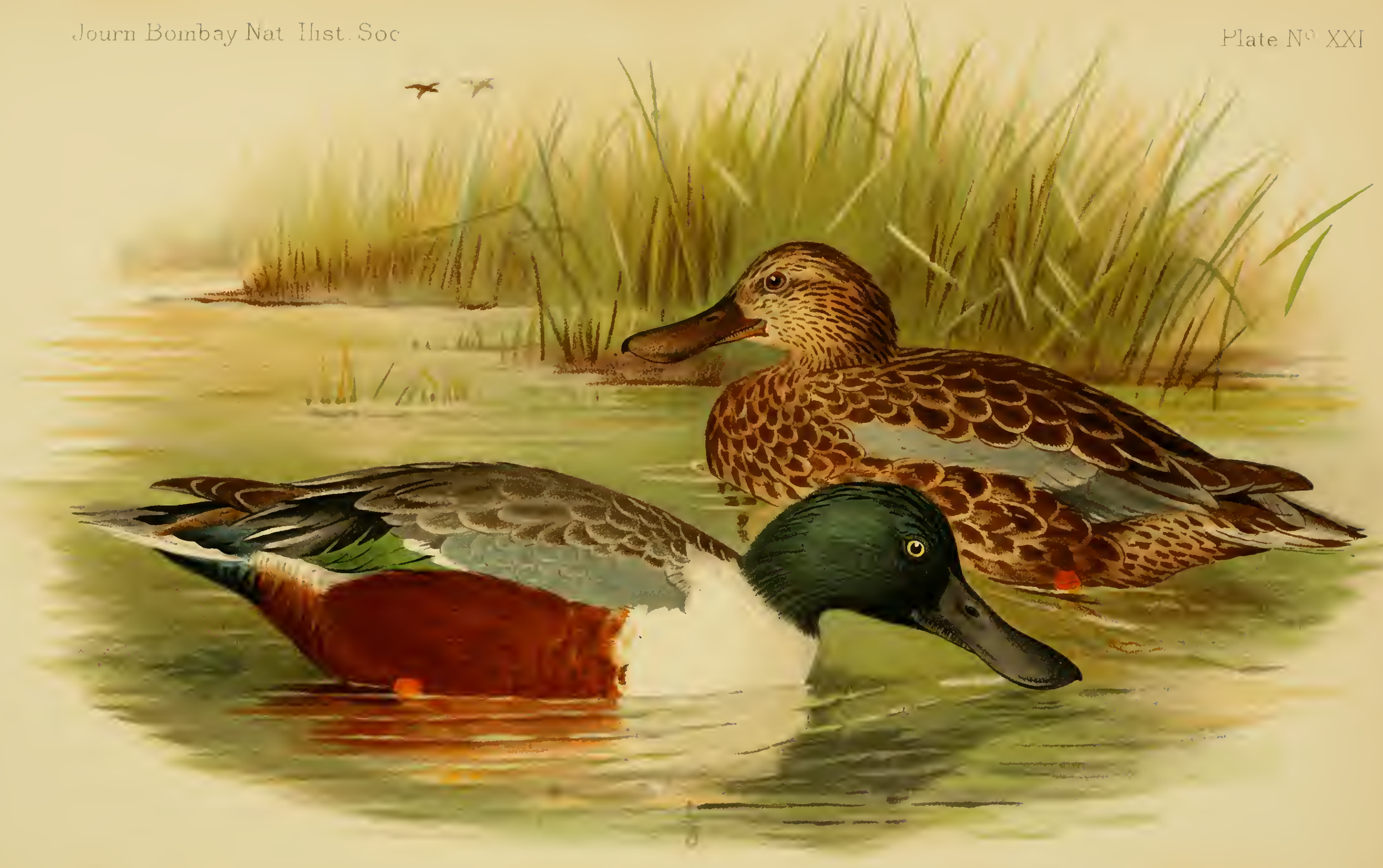
3 Cameos and 1 pearl scarf pin, lent by Messrs. Marcks and Co., Bombay.

1 Revolver with Mother-o'-pearl handle, from Messrs. Hollis and Co., Bombay.

Seed pearls presented by H. H. the Rao Saheb of Cutch.

The shells used in India for making building lime.

The shells of edible species used in India as food.



H Gronvold del

Mintern Bros Chromo-lith London

THE SHOVELLER
Spatula clypeata

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVI. BOMBAY. No. 3.

DESCRIPTION OF NEW SPECIES OF MOTHS FROM INDIA AND BURMA.

By G. C. Dudgeon, F.E.S.

(*Read before the Bombay Natural History Society on 6th July* 1905)

ZYGÆNIDÆ.

CHALCOSIINÆ.

Soritia viridibasalis, n. sp.

♂. Head, thorax, first three abdominal segments dorsally and whole of hindwing, which latter is unmarked, fuscous brown; terminal segments of abdomen dorsally and laterally light blue; breast, undersurface of abdomen and first joint of palpus buff-white; collar crimson. Forewing rather narrow, dark brown with an almost straight, pale primrose, oblique postmedial band from the costa at the end of the cell to the posterior angle, this band is about 2¼ millimetres in width throughout and farther from the base than that of *nigribasalis*, Hmpsn.; all veins and interspaces on the basal two-thirds of the wing nearly as far as the pale band suffused with green; veins from just before the pale band and beyond it defined with blue-green, within these limits there is no suffusion in the interspaces. Underside fuscous brown without the green suffusion; the postmedial band broader with a curved subapical light-blue band beyond it; hindwing with the whole of the cell, a streak on each side of vein 1c. and a submarginal series of four lunules light-blue.

This species differs from *nigribasalis* in the green suffusion on the basal two-thirds of the forewing, the position of the pale band on the same wing, and the absence of any markings on the hindwing. The white undersurface of the abdomen and the blue lunules on the undersurface of the hindwing are also distinctive marks.

Habitat.—Daunat Range, Tenasserim (*Hauxwell*). *Exp.* 36 mill. *Type*—In coll., Dudgeon.

ACANTHOPSYCHE (METISA) THEIVORA, n. sp.

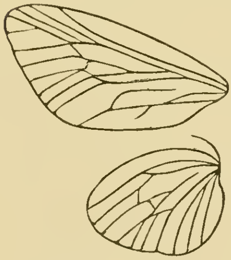
Characteristics.—Fore tibia with a spine : veins 1b. and 1c. of the forewing anastomosing. Out of four examples in the Indian Museum collection two have a veinlet from beyond the juncture of veins 1a and 1b. towards the inner margin and two are without a trace of this veinlet : veinlets in the cells of both wings with long forks : a bar between veins 7 and 8 of the hindwing.

♂. Head, thorax, abdomen and both wings uniform fuscous.

Larval case composed of fragments and whole leaves attached to a rather soft case. The food plant is said to be *tea.*

Habitat.—Sikhim. *Exp.* 30-33 mill. *Type*—In the Indian Museum collection.

This species has been identified in the Indian Museum collection, one specimen said to be by Sir Geo. Hampson, as *Amatissa consorta*, Templ., but this is a palpable error as both in form and neuration it is widely distinct from that species. The neuration best corresponds to that of the subgenus *Metisa* of *Acanthopsyche*, but it will be seen from the above description that it is not quite normal. Both wings have vein 6 present and 4 and 5 from a point.



Acanthopsyche (Metisa) theivora, Dudgeon.

The absence or presence of a single veinlet from 1b. towards the inner margin in the forewing appears to be a character of not even specific value.

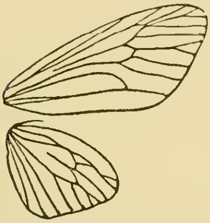
Owing to the wrong identification of most of the insects of this family in the Indian Museum collection, considerable confusion has been caused in publications referring to them as agricultural pests. Names seem to have been attached to specimens utterly regardless of whether they were even generically correct. Incredible as it may seem, one describer has given a name to an insect of which only the larval case was known, the moth not having been procured. To give a new name to a lepidopterous insect upon such data is equivalent to the description of a new botanical species from the possession of a piece of the root only.

PSYCHIDÆ.

MAHASENA DESTRUCTOR, n. sp.

Characteristics.—Fore tibia with a spine : veins 1b. and 1c. of the forewing anastomosing without veinlets to the inner margin: cell of both wings rather long: forewing with all veins present, 4 and 5 and 8 and 9 on long stalks, 6 reaching the margin close to termination of 5, veinlet in the cell with very short fork or none : hindwing with 4 and 5 stalked, vein 8 anastomosing with 7 twice, before and after the cell forming a triangular areole and reaching the margin separated again. This latter peculiarity I have not seen in any other species of the genus.

♂. Head and thorax covered with long greyish hair, sides of the latter defined with dark brown. Forewing greyish brown with a slight cupreous tinge, nervules defined with black, the basal two-thirds of the interspace between 3 and 4 with an elongate hyaline spot, a marginal triangular buff-white spot between veins 6 and 7 and smaller buff marks on the margin between veins 4 and 5 and 7 and 8, these latter sometimes wanting. Hindwing uniform cupreous brown with the veins slightly defined with darker.



Mahasena destructor, Dudgeon.

Larval case formed of twigs of the tea plant placed longitudinally.

Habitat.—Sikhim and Bhutan, 1,000-4,000 ft. *Exp.* 20-23 mill.

Type—In coll., Dudgeon. There are also six specimens of this species in the Indian Museum, three of which are marked as tea pests from Chittagong received from Mr. Wood-Mason.

This insect is the most destructive tea Psychid in the Darjeeling and Terai districts and has long been confounded with *Clania crameri*, with which it is superficially somewhat similar. It can be immediately distinguished by the forewing wanting red markings and by the position of the elongate pale marginal or submarginal spot, a conspicuous one filling the whole fork between veins 4 and 5 in *C. crameri*, whereas *M. destructor* has the largest conspicuous pale spot between veins 3 and 4 and has only a marginal speck between veins 4 and 5.

NOCTUIDÆ.

ACRONYCTINÆ.

NONAGRIA UNIFORMIS, n. sp.

Neuration.—Vein 6 of the forewing from the angle of the cell.

Section I. veins 3 and 4 of the hindwing from the cell.

D. Antennæ of the male fasciculate.

♂ and ♀. Forewing uniform brownish ochreous sprinkled with a few fuscous scales chiefly in the cell and on the inner and outer margins, forming minute spots sometimes, one below the median nervure before the origin of vein 2, one below vein 2 half-way to the outer margin and two below vein 6, one of which is just beyond the discocellulars and the other half-way to the outer margin ; the outer margin defined with an internervular row of dark specks; cilia long and intermixed with fuscous. Hindwing pure white unmarked irridescent near the base and below the costa. Sides of palpi and inside of tibiæ of forelegs of the male dark brown. Female with the antennæ simple and the palpi and forelegs unmarked.

Habitat.—Burogah, Bengal; Surat, Bombay. The larva is reported as destructive to sugarcane. *Exp.* ♂ 29 mill.; ♀ 30-37 mill.

Types sent to British Museum.

This species differs from any other described Indian species of *Nonagria* in that the antennæ of the male are fasciculate combined with veins 3 and 4 of the hindwing being from the cell. The collection of dark scales forming specks on the forewing are placed similarly to those found in *Nonagria inferens*, Wlk.

Described from four specimens sent me by Mr. Maxwell-Lefroy and received by him from Mr. Mackenzie, and from others collected by the former gentleman in the Bombay Presidency. There are several examples also in the Indian Museum collection.

ERASTRIANÆ.

Erastria niveiguttata, Dudgeon; Jour. Bo. Nat. Hist. Soc., Vol. XIII, p. 85, plate II, fig. 4.; Dudgeon in Hmpsn., Jour. Bo. Nat. Hist. Soc., Vol. XIV, p. 205.

Sikhim, 1,800 ft. *Type* in B. M. coll.

ACONTIANÆ.

PTEROGNIA IRRORATA, n. sp.

Section II. B. Forewing with the cilia crenulate, outer margin more angled. Male with antennæ fasciculate, female minutely ciliate.

♂. Forewing ochreous, suffused with pearly white and striated with ferruginous, the striations coalescing on the discocellulars and below the end of the cell also beyond the postmedial line towards the posterior angle. The thorax and forewing clothed with large flattened scales. Forewing with a pale subbasal line; an antemedial whitish line oblique to just below the origin of vein 2 whence it is waved to the centre of the inner margin, this line as well as the basal portion of vein 2 is defined outwardly with dark brown; a black patch at each angle of the cell; a sinuous postmedial whitish line defined outwardly with ferruginous; a submarginal series of dark patches of scales below veins 2, 3, 4 and 5. Cilia long and ferruginous, extending along the inner as well as the outer margin. Abdomen and hindwing pale, the outer area of the latter broadly fuscous. Retinaculum bar-shaped.

♀. Differs from the male in being less ferruginous, the brown striations being of a warmer tint. There is also a large gold lunate spot on the discocellulars generally with a small gold spot attached at its centre outwardly and a dark spot at its lower extremity. The antemedial line is continued in its obliquity to the margin, meeting the latter just before the origin of the postmedial line; there is no dark definition of vein 2. The antennæ are minutely ciliate towards the ends. Underside of both sexes with an oval buff discocellular spot and broad marginal buff band on both wings, the ground colour being fuscous.

Habitat.—Sikhim 1,800 ft. Bhutan 2,500 ft. *Exp.* Male 40-43 mill. Female 44-48 mill.

The male is somewhat similar to *P. striatura*, Moore, from the description, but is much larger and has the antennæ fasciculate. The female is somewhat like *P. episcopalis*, Swinh., but has crenulated cilia to the forewings and the metallic spot gold and smaller.

Described from four males and five females in my collection.

SARROTHROPINÆ.

Barasa costalis, Dudgeon in Hmpsn. Trans. Ent. Soc., Lond., 1895, p. 305; Dudgeon Jour. Bo. Nat. Hist. Soc., Vol. XIII, p. 268, pl. III, fig. 29. Sikhim; Bhutan, 1,800-2,500 ft. *Type* in coll. Dudgn.

FOCILLINÆ.

Zethes macariata, Dudgeon in Hmpsn. Jour. Bo. Nat. Hist. Soc., Vol. XIV, p. 216. Sikhim, 1,800 ft. *Type* in B. M. coll.

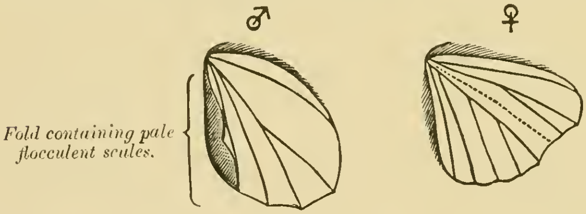
This species superficially resembles a Macaria in markings.

EPIPLEMIDÆ.

Dirades unicauda, Hmpsn.

I have recently reared a number of both sexes of this species from larvæ found feeding upon the young leaves and buds of *Gardenia.* The male is exactly similar in shape and markings to Hampson's figure of *Dirades binotata*, Hmpsn., but cannot be identical with it, as *D. binotata* is placed as synonymous with *D. theclata*, Moore, in Moths of India, Vol. III, and this latter species is figured as having veins 2, 5, 6, and 7 developed in the hindwing of the male, which is not the case in my specimens. The females reared by me have all the veins of the hindwing developed, and correspond fairly well with Hampson's figure of *Erosia unicauda* in Ill. Het. VIII, fig. 21, which is undoubtedly a female though recorded as a male. Were it not for the neuration of *D. theclata* being distinctly shewn as more or less normally formed in Moths of India and the sexual patch shewing it to be a male, I should have said that the insect called *D. theclata* was the female of *D. unicauda*, as the description of the former corresponds fairly well with the latter.

The accompanying sketch shews the neuration of the hindwings of both sexes of *D. unicauda* bred by me.



The larva is brownish grey covered over with shiny black tubercles with yellowish suffusion round their bases each bearing a few short hairs. The cocoon is formed of particles of mould or dry leaves webbed together below or on the surface of the ground. My specimens were in the pupa state for ten days and emerged in August and September.

The female insect has the forewing identically similar to the male, but it is more violaceous. The hindwing is violaceous grey with the medial line angled on vein 4, and the postmedial area with a somewhat shining reddish subcostal patch. The tails are well developed at the extremities of veins 4 and 7 and less so at vein 6. Vein 5 is very weak but traceable nearly to the base, the discocellular veins are wanting. (Vein 5 at first sight appears very distinct owing to its being in the line of the wing fold, but it is scarcely recognisable in a transparency.)

PYRALIDÆ CRAMBINÆ.

Chilo auricilia, n. sp.

Antennæ of the male flattened by coalescing lamellæ separated distinctly.

♂. Brownish ochreous, irrorated with fuscous; a raised dark-metallic spot in the cell, another at the origin of veins 4 and 5, one above and one below vein 2; a few golden scales in and beyond the cell; a postmedial row of black dots incurved towards the costa with golden scales upon them; a marginal row of black dots; cilia golden. Hindwing brownish white; cilia slightly silvery.

♀. Differs from the male in being larger and in having the ground colour pale ochreous with the metallic spots smaller. Antennæ simple.

Habitat.—Burogah, Bengal; Sikhim and Bhutan. *Exp.* Male 18 mill., female 25-27 mill.

Type sent to British Museum.

Described from one male received from Mr. Maxwell-Lefroy sent him by Mr. Mackenzie and from five females in my own collection, one of which had been marked "*Platytes argentisparsalis*, Hmpsn." by Sir Geo. Hampson. Mr. Mackenzie has found this insect doing damage to sugarcane in company with *Chilo simplex*, and both species have been reared by him.

ANERASTIINÆ.

Polyocha saccharella, n. sp.

Section II, B. Differs from Sect. II, Hmpsn. in Moths of India, Vol. IV, in vein 10 of the forewing not being stalked with 8 and 9. Antennæ of the male with a large tuft of bicoloured scales in the sinus at the base of the shaft and uniseriate rather short branches. Palpi obliquely upturned in the male, rostriform in the female.

♂. Head, thorax, abdomen and forewing uniform pale ochreous brown more or less suffused with fuscous in and beyond the cell. Hindwing white.

♀. Differs from male in wanting the fuscous suffusion except slightly at the apex of the forewing.

Habitat :—Burogah, Bengal. *Exp.* 32-34 mill.

Types sent to British Museum.

Several specimens of this species were sent me by Mr. Maxwell-Lefroy reared by Mr. Mackenzie. It is said to be destructive to sugarcane in Behar.

"THE" COMMON STRIPED PALM SQUIRREL.

By R. C. Wroughton, F.Z.S.

(With a Plate.)

(*Read before the Bombay Natural History Society on 6th July* 1905.)

Blanford in his "Mammals" describes the common striped palm squirrel under the name of *Sciurus palmarum*, L.

Since the "Mammals" was published, however, Mr. Thomas, in the P. Z. S. (1897, p. 925), referring to a paper published by Dr. Forsyth Major, on the subdivisions of the *Sciuridæ* (P. Z. S., 1893, p. 179), wrote :—" This general arrangement being founded on such a careful and highly competent examination of the skulls and teeth, it was evident .... that systematic workers would have to consider how best they could utilise Dr. Major's invaluable contribution to the subject. .... I would now venture to suggest that all the subgenera (with the exception of *Atlantoxerus*) in Dr. Major's scheme should be recognised, for ordinary systematic purposes, as full genera, especially as all of them have long been considered as perfectly natural groups and have been arranged as such in the revisions of Trouessart and other authors." Again in the "Ann : and Mag :" (1898, Ser. 7, Vol. II, p. 249), Mr. Thomas wrote :—" For the information of workers in the East, to whom all the literature may not be accessible, it may be noted that by the recent splitting up of *Sciurus* into several genera .... the Indian squirrels—taking Blanford's 'Mammals' as a standard—*S. bicolor, indicus, macrurus* belong to *Ratufa* ; the species (except *rufigenis* and *lokriah*) from *ferrugineus* to *atridorsalis* and also *maclellandi* to *Sciurus* ; and *S. rufigenis*, *lokriah*, *palmarum*, *tristriatus*, *layardi*, *sublineatus*, and *berdmorei* to *Funambulus*."

Hence in the Table on p. 370 of the "Mammals" if *lokriah* and *rufigenis* be put under C and *maclellandi* under B. we shall have—

A = Gen. *Ratufa.*
B = Gen. *Sciurus.*
C = Gen. *Funambulus.*

As a first step then our common striped palm squirrel becomes *Funambulus palmarum*. But, since I obtained, in 1898, two striped squirrels, within ½ mile of each other, on the north bank of the Tapti River, about 40 miles from Surat, I have felt convinced that more than one form was lumped under the specific name *palmarum*. Lately

I have had an opportunity of examining the skins and skulls in the National Collection at South Kensington. Though the material available for study is unfortunately still very limited, there is enough to show very clearly that there are at least two quite distinct forms :—

A. With three pale dorsal stripes and a band of short, bright rufous hairs along the underside of the midrib of the tail.

B. With an additional pale stripe on each side, sometimes indistinct but always discernible, and having no rufous band of short hairs under the tail.

My difficulty has been to decide which of these forms is the *palmarum* of Linné and to settle the question I have gone rather thoroughly into the literature.

Clusius, in 1606, described an animal under the name of *Mustela africana.* His description is confessedly based on a picture and some notes, furnished to him by a friend, Jacobus Plateau (of Rouen ?) He wrote of it " in utrâque mandibulâ binis longioribus dentibus in anteriore rictus parte prœditus : comedens, clunibus insidebat, anterioribus pedibus cibum tenens et versans," which rather indicates a squirrel. He added : " Cauda quidem attollens, minime tamen supra caput retrorquans sed in latum nonnunquam valde explicans, pavonis caudœ pœne instar." Any one who has watched the palm squirrel will recognise this as a fair description of him, by a man who was mentally comparing him with the European squirrel. All this Clusius must have got from his friend's notes, but when he adds " pedes in quinque digitos erant divisi, quaternos antrorsum spectantes ………… quintum autem brevem, retrorsum spectantem " he certainly was describing from his picture.

There followed notices of this *M. africana* by—

Eusebius Nierembergius in 1635.

J. Jonston in 1657.

J. Ray in 1693.

but all these were merely paraphrases of, or extracts from, the original account by Clusius.

In 1762 Brisson published his " Regnum Animale," from which I quote in full :—

" *Sciurus palmarum ; Mus palmarum* (Vulgo.)

Sciurus coloris ex rufo et nigro mixti tœniis in dorso flavicantibus—*L'écureuil Palmiste.*

2

Raj. Syn. quad., p. 216.

Clus. Exot. p. 112.

Johnst. Quadr., p. 105.

Eus. Nieremb. Fig., p. 172.

Pili corporis ex rufo et nigro variegantur : pili caudœ supra ex nigro et flavicante, infra vero sunt ex flavo rufe, cum duabus tœniis longitudinalibus in utroque latere nigris, altera tœnia etiam longitudinali albicante utrinque terminatis : tres sunt, insuper in dorso, secundum ipsius longitudinem, tœniœ flavicantes, in utroque scilicet latere una, alter in medio dorso.

Habitat—Asia, Africa, et America."

There is a mark against this species which, as explained in his preface, means a species " quam propriis oculis examinare mihi fiat concessum."

There are three points in this description to which I would call attention, *viz.* :—

1. For the first time 3 pale dorsal stripes are mentioned.

2. The rufous band along the midrib of the tail below is distinctly mentioned.

3. No mention is made of the three-toed fore-feet.

In 1766 was published the XII edition of Linne's " Systema Naturæ " (*S. palmarum* is not mentioned in the X edition). The notice of this species (Lib. 1, p. 86) is as follows :—

Sciurus palmarum.

S. subgriseus, striis tribus flavicantibus, caudaque albo nigroque lineata.

Sciurus coloris ex rufo et nigro mixti, lineis in dorso flavicantibus. Briss : Quad : p. 156.

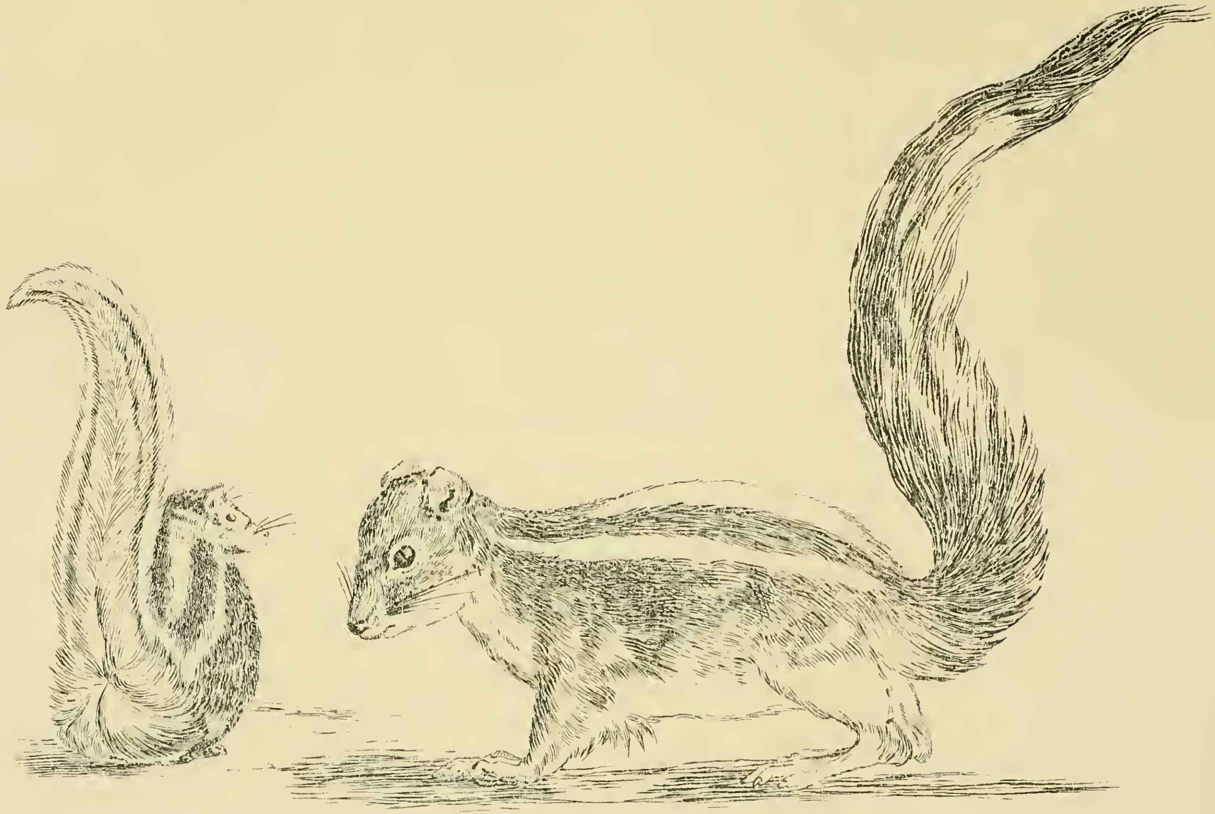
Mustela africana. Clus : Exot : p. 112. Raj : Quad : p. 216.

Habitat—America, Asia, Africa.

Cauda disticha erecta non abumbrans Pedes 4-5. Auriculœ rotundœ."

In the absence of any specific indication in his own description the fact that Linne quotes Brisson as his authority establishes the form with 3 pale dorsal stripes and a rufous band under the tail as the typical *palmarum*, L.

The puzzling point is where did Linne get his character " Pedes 4-5 " ? for none of his authorities mention it. The only place he could have found it was Vol. X of Buffon's ' Histoire Naturelle ' which was published in 1763. I extract from it a description of " *Le Palmiste.*"



BUFFON—Histoire Naturelle. 1763.

" Le Palmiste qui a servi de sujet pour cette description n' était pas adulte...............Il y avait cinq doigts aux pieds de derriére et seulement quatre á ceux de devant...............La couleur du poil de la queue était mêlee de gris et de brun noirâtre qui semblait former des anneaux forts étroits, chaque poil avait du noir prés de la racine, du gris audessus du noir et enfin du noir à la pointe.

Jái observé un autre palmiste qui était empaillé et qui m'a paru de même espèce que le précédent ....Les poils de la queue formaient un panache, chaque poil était de couleur rousseatre â son origine, il avait ensuite du noir, du rousseâtre, du noir et enfin l'éxtrémité était blanche."

I have seen no specimen in which the hairs of the tail were tipped with black. But whatever the immature specimen may have been the other was almost certainly the same form as the one described by Brisson and possibly the same specimen. Moreover Buffon's plate shows, as clearly as is possible in an uncolour picture, the rufous band of short appressed hairs on the undersurface of the midrib of the tail. (*Vide* plate which is carefully copied from Buffon's picture, omitting only the background, and for which my acknowledgments are due to Miss Edwards.)

Neither Brisson nor Buffon gives an exact locality for the specimen on which he bases his description. But it would probably be the E. coast of Madras ; at any rate in the absence of any more exactly indicated locality I think we may accept the three striped form of Madras as the typical form of *Funambulus palmarum*, L. and I propose to make a new species for the five striped form under the name of *Funambulus pennantii.*

FUNAMBULUS PALMARUM, L.

Sciurus penicillatus, Leach, Zool : Misc : Vol. 1., p. 6, 1814.

Funambulus indicus, Lesson, Ill : de Zool : Pl. XLIII, 1832.

The individual hairs on the upper surface of the body, including the face, vertex (which however is often strongly tinged with red). Shoulders and flanks are particoloured, or broadly ringed, with black and dirty white or pale buff, the general result is a very finely speckled appearance varying from red-brown to grey-brown according as the pale portions of the hairs approach more or less to buff. On the back there is a 'saddle-mark' area always darker than the general body colour and usually much redder or browner. This variation in colour however seems to be purely individual for in the fine series of specimens from Trivandrum there is a specimen in which this saddle-mark differs from the body colour in little more than shade and even that only slightly while in another it approaches black as in *F. trisriatus.* Waterh. and there are all intermediate grades. Down the centre of this saddle-mark, from the nape to the base of the tail is a pale coloured streak, which corresponds in colour with the paler portions of the body hairs, just inside the lateral edges of the saddle-mark are two similar streaks, parallel to the central one; the exact distance inside the edge of the saddle-mark varies in different individuals. The lower surface of the body from the chin to the vent and including the inside of the legs is dirty white to pale buff; where the upper and lower colours meet along the sides there is often an area on which the pale belly colour is strongly tinged with brick red. Lesson's plate of *F. indicus* represents an exceptionally pale animal and shows the pale colour extending from under the chin upwards over the cheeks to the eyes, Leach's plate of *penicillatus* does not; both forms are present among the Madras, &c., specimens. The rump and lower surface of the tail are coloured a bright cinnamon brown, the hairs on this red band of the tail are short like those of the body while the rest of the tail hairs are long (1 inch or more), and annulated, commencing with buff at the root, then black, white, black and well marked white tips. Looked at from above the tail appears to be obscurely, transversely barred black and white; while from below there is seen a central rufous band bordered with black which again is bordered with white.

Length of head and body about 150 mm. ; tail about the same.

Habitat.—MADRAS.

F. tristriatus, Waterhouse, is apparently the forest form of *palmarum* and the latter is probably the former adapted to civilisation, though having been named earlier it is senior ' systematically ' to *tristriatus. F. tristriatus* is much the darker of the two, the palest specimen I have seen being darker than the darkest *palmarum*; the rufous vertex of the head which is without exception in *tristriatus* is often absent in *palmarum*; and the obscurely barred appearance of the tail of *palmarum* is wanting in *tristriatus,* owing to the greater length of the white tips of the hairs. Waterhouse gave no locality for the type of his *tristriatus* except ' S. India ' but there are specimens in the National Collection from Madras (? Presidency) and Travancore. I have tabulated the skull measurements of these as well as of the corresponding forms of *palmarum* and of the specimen from Guzerath referred to at the commencement of this paper. I have taken the measurements of the type *tristriatus* from its skull but I find they agree almost exactly with those given (in inches and lines) by Waterhouse in his paper in P. Z. S., 1889, p. 118.

	F. tristriatus.			*F. palmarum.*		
	Type.	Average Madras specimens.	Average Travancore specimens.	Average Madras specimens.	Average Travancore specimens.	Guzerath specimen.
Greatest length of skull	40·75	40·25	44	37·5	40·5	40
Zygomatic breadth	24	24	25	21	23	23·5
Interorbital breadth...	13·25	13	13·5	11	11·5	11·5
Length of nasals	12·5	13	14	12	12	12
L. of upper tooth row	9	8·5	9	7·5	8	8
Palate from henselion	19	19·25	20·5	17	18	18

The way in which the increased skull measurements of Travancore *tristriatus*, over the type, are repeated in *palmarum* is significant, and I think justifies the separation of the Travancore form as a geographical race or sub-species.

F. palmarum, L. comorinus............... .. sub. sp. n.

Differs from *typicus* by its much soberer grey colouration and by its larger skull measurements as given above.

Habitat.—TRAVANCORE.

Type. ♀ B. M. 95. 10. 9. 19. Obtained by Mr. H. Ferguson at Trevandrum, 23rd January 1895. Many specimens.

FUNAMBULUS PENNANTII. sp. n.

Palm squirrel. Pennant, Hist. Quad. Ed. III, p. 149, 1793.

Habitat.—Mandvi Taluka of Surat District.

Type : ♂ B. M. 98. 4 2. 25. original number 45, obtained by myself, 27th February 1898. Length as in *palmarum.*

The body colouring is very much as in *palmarum, comorinus* but along the outside edge of the 'saddle mark,' on each side there is a supplementary pale stripe. This stripe being bounded on the outer side by the general body colour, and that too at a point where it is commencing to pale down to the meeting line with the belly colour, seems often faint but is always discernible. There is no band of short, rufous hairs along the midrib under the tail as there is in *palmarum*. All the tail hairs are long, and ringed black and white as in the upper tail hairs of *palmarum*.

Pennant gives no locality for the specimen he describes; he says however "Governor Loten did me the favour of informing me that it lived much in the coco trees and was very fond of 'sury' or palm wine, which is procured from this tree, from which it obtained the name of 'suricatsje' or the little cat of the 'sury.'" I have failed to identify the 'Governor Loten' mentioned in this extract, but 'Hobson Jobson' gives 'sury', or 'soure' as a name used for toddy by Tavernier (1663) and de la Boullaye le Gouz (1650). The latter certainly wrote from Surat so I think we may accept Guzerath as the home of Pennants' *Palm Squirrel*. I have, therefore, taken the specimen obtained by me in the Mandvi Taluka of the Surat District as the type of a new species which I have named after the eminent English Zoologist Pennant who first described it.

The following table gives the skull measurements of the type of *pennantii* as compared with the Guzerath specimen of *palmarum* which I obtained at the same time and with a form from Rawalpindi :—

——	Guzerath *palmarum*.	Typical *pennantii*.	Rawalpindi *pennantii*.
Greatest length of skull	40	39	38
Zygomatic breadth	23·5	22	22
Interorbital breadth	11·5	11	10·5
Length of nasals ...	12	11·5	12
Length of upper tooth row	8	7	7
Palate from henselion	18	16	16

Funambulus pennantii argentescens, ...sub. sp. n.

The pattern of the colouration is identical with that of typical *pennantii*; it is much paler however and almost all rufous tint has disappeared, the general body colour is a pale French grey and the stripes and belly bright white. The skull measurements given above indicate a narrower face and somewhat longer muzzle and the animal generally is somewhat smaller.

Type : ♀ (B. M. 5. 4. 2. 3.) Original number 13; obtained by Major Birrell, R.A.M.C., at Rawalpindi, 10th December 1900. Five specimens (3 immature) presented to the Museum.

There are other specimens in the collection which seem to show that there are other local races deserving separation, but no localities are given.

It would almost seem that *palmarum* is a South, and *pennantii* a North Indian form, but there is not sufficient material available to theorise profitably; all that I can at present say is that they occur together on the West Coast at about 21° N. Lat. and even so much 'without prejudice'. We know that in S. India where *tristriatus* occurs as the Forest form, *palmarum* is found about human dwellings and cultivations, where *pennantii* is the 'civilised' form, what is the Forest form? This and the interesting question of geographical variation in the two species must wait till more localised specimens are available. May I appeal to members for specimens? There is no difficulty in obtaining specimens anywhere or at any time of the year; printed instructions for 'making' specimens may, I believe, be obtained from our Hon. Sec. (if not I shall be happy to furnish them to any one who will write to me) and —experto crede—there is very little difficulty in 'making' the specimens—any smart native servant can be taught to do it satisfactorily, *provided the measurements are personally verified.* *Any* specimens will be gratefully received by the Director of the Natural History Museum. (Cromwell Rd., London, S.W.).

It remains only for me to record my obligation to Mr. O. Thomas of the N. H. Museum for the advice, sympathy and encouragement he has given and always been ready to give me, and I wish also to acknowledge the kindness of Mr. Gerrit S. Miller of the United States National Museum, Washington, U.S.A., who, though he himself had only a limited time for work at South Kensington, repeatedly spared some of it to help a beginner.

ROUGH NOTES ON SIX COMMON HILL ORCHIDS.

By Major M. B. Roberts,
1/39th Garhwal Rifles.

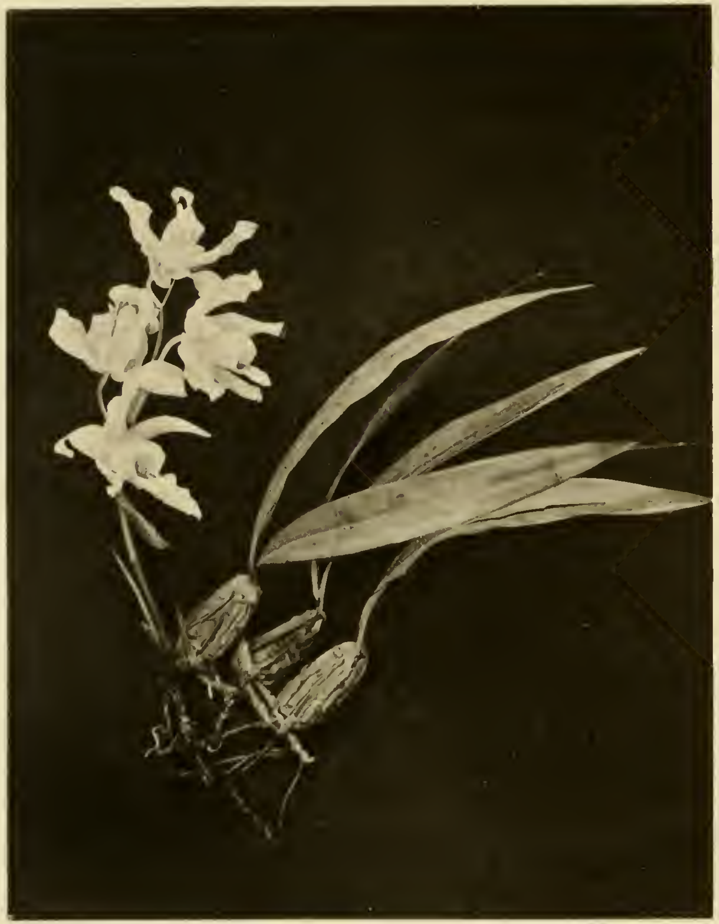
With 3 Plates.

(*Read before the Bombay Natural History Society on 6th July* 1905.)

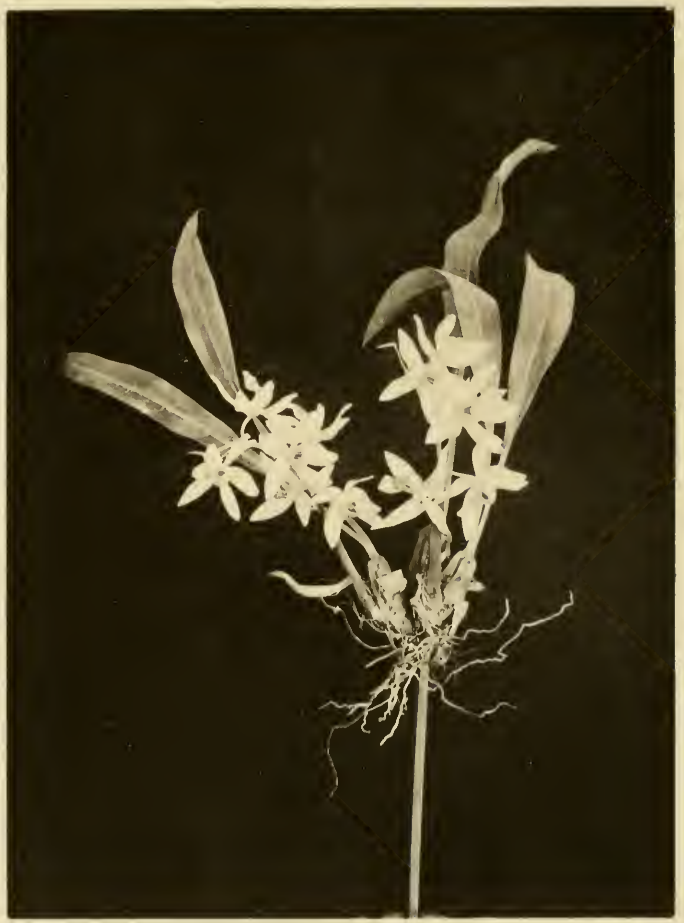
I have written the following rough notes on orchids (though absolutely ignorant of the science of botany, I regret to say) partly on account of seeing an appeal to members to send in contributions to the Journal and partly in the hope that some member well versed in the subject may give us the benefit of his knowledge and experience in an article or series of articles on orchids.

Of all the beautiful and interesting flowering plants, orchids form, perhaps, one of the most interesting orders. And what, it may be asked, causes so much interest to be taken in this particular order of plants? The answer to this question is necessarily a long one; but, to put it as concisely as possible, the great attraction that orchids have for one lies in:—(1) The enormous size of the order and its wide distribution all over the world, except in the coldest regions; (2) the great beauty and delicious scent of the flowers of many kinds on the one hand and the weird forms (often amounting to the mimicry of insects and, it may be added, to the mimicry of evil smells—a Bulbophyllum from Borneo imitates the smell of a dead animal) of some on the other; (3) the marvellous ways in which many genera propagate themselves or can be artificially propagated and the even more wonderful means that Nature has devised for their fertilisation by insect agency; and (4) the peculiar and widely differing habits that various genera exhibit both in their modes of growth and of flowering. There are many other items which one could add to this list, but the above will suffice.

But, unfortunately, there are several obstacles in the way of the amateur who wishes to learn even a little of this large subject, chief among which is the difficulty of obtaining any moderately priced and not too scientifically written books on orchids. There are, of course, many splendid scientific works on the subject which are comprehensible to the botanist; but these are not only very unintelligible to the ordinary mortal, and are beyond the reach of most of us financially, but such works can only be found in large libraries which do not exist where many of us are stationed.



COELOGYNE CRISTATA.



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COELOGYNE OCHRACEA.

What the amateur in India requires is a simply written, well illustrated book describing the best flowered varieties of orchids and giving instructions how to grow them, water them, and allow them to rest; the latter being one of the most important points in growing orchids successfully.

Many of the finest orchids in existence come from Burma and Assam, whilst India and Ceylon can boast of a great number of beautiful kinds. So if only some one could be found to write a book on the lines above suggested for the orchids of these countries, it would be a great boon to us amateurs. I have seen large quantities of a lovely orchid ruthlessly wasted out of sheer ignorance of the habits and requirements of the plant. In the particular case referred to, these orchids were obtained from a deeply shaded ravine, and, on arrival, they were put on the top of a dry masonry wall in the blazing sun with the idea that they would flourish there. Needless to say, they never flowered, and were soon scorched up to nothing. If these same plants had been wired on to a large shady tree, they would not only have flowered well, but, by now, would have nearly covered the tree, and, for six weeks every year, would have been a sight worth going far to see.

In the following notes on a few common local orchids it should be noticed that they have special reference to orchids found in the Central Himalayas between Naini Tal on the East and Mussoorie on the West, for it seems quite probable that similar orchids obtained from Darjeeling or Assam might be found at totally different altitudes, whilst their seasons of growth, flowering, and rest would doubtless be much affected by the differing climates of these localities.

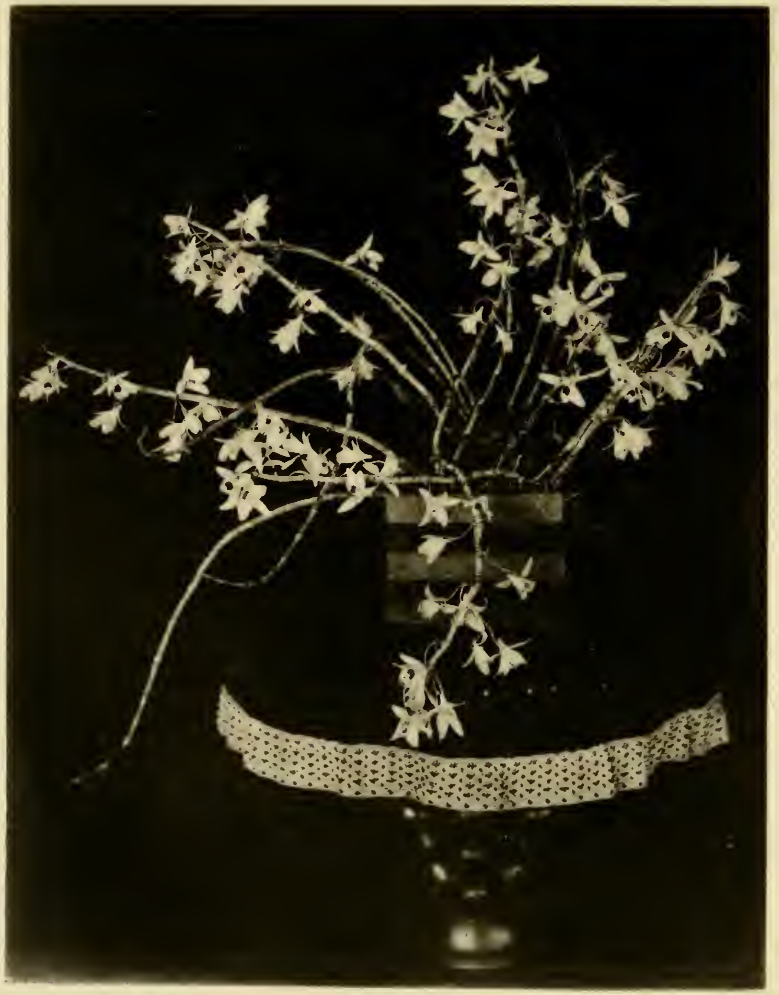
1. *Cœlogyne cristata.* (Plate A.)—A beautiful epiphyte, growing mostly on oak trees or on well shaded rocks from 5,000 to 6,000 feet above sea level. Season of rest, October to February (inclusive). Season of flowering, March and April. Season of growth, immediately after flowering till September. This is a handsome evergreen plant, composed of a strong ground-stem, from below which the wiry roots grow, while from the top at intervals the semi-transparent green pseudobulbs are thrown out, one every year. These pseudobulbs are about two inches long, and in all orchids possessing them they form the natural reservoirs from which the plant keeps up its strength during the season of rest; at the end of the growing season they have become very fully inflated as it were, whilst by the end of the season of rest they are much shrivelled,

though still containing moisture. From the top of each bulb grow two lance-shaped leaves which last for three or four years. The flower stalk begins to show in February from below the last-formed pseudobulb. The normal number of flowers in the wild plant is five, though six are occasionally found. They measure about three inches across, are pure milk-white with beautifully waved petals and sepals, and have a yellow stain on the lip and its crests.

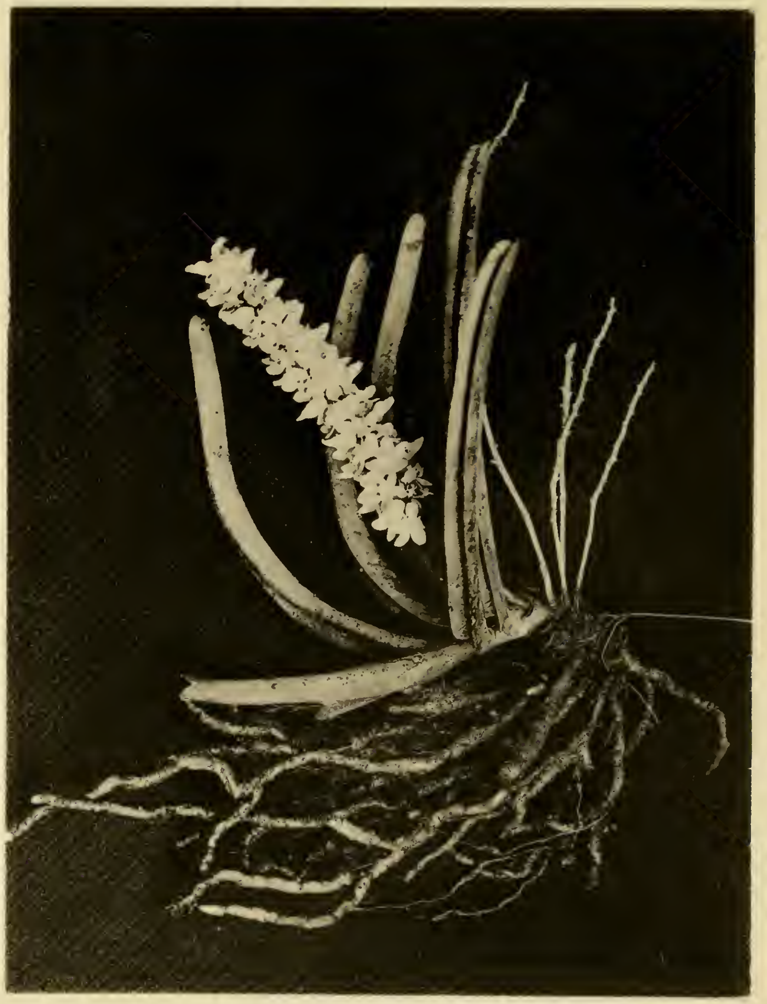
It is a pity to cut these lovely flowers, for they soon fade : if required for table decoration, it is better to include the stem with two or three pseudobulbs and roots complete, for the latter can easily be hidden in moss, and under these conditions the flower will remain perfect for three or four weeks with a little ordinary care ; and when it shows signs of fading, the plant can be wired on to the bark of a shady tree, with the certainty that it will grow and thrive and flower again next year.

Next to growing these orchids on shady trees or rocks, the most effective way is to plant them in a large shallow wooden tub which is easily made out of the bottom of a cask. This tub must be well drained with large holes cut in the bottom, and it should be raised off the ground to prevent any chance of the drainage holes becoming filled up with soil. It should be filled with lumps of charcoal of all sizes, pieces of broken pots or brick, bits of fibrous wood, a few dead leaves, and a little sand the mixture should quite fill the tub and be higher in the centre. Then the plants (having had all useless old stems, pseudobulbs, and roots cut off) are laid on, and their roots covered over with moss, the whole being secured with copper wire. Such tubs should be looked to every year, for these orchids grow fast, and overcrowding only leads to much deterioration.

Water should be given very sparingly when the plants show signs of flowering, and in increasing and finally large quantities during the season of growth, at the end of which it should be gradually diminished and then entirely stopped. On no account should water be given to any orchid (except in very small quantities) during the season of rest, for by doing so either the plant will be forced into fresh growth at an unnatural season, or, should the flowering season be near, it will be found that this causes the newly formed flower buds to shrivel up and drop off—to " damp off " as it is technically termed. The only exception that should be made to this rule is in the case of a weakly plant which it is necessary to force into strong growth, but in this case no flowers can be looked for until the following year.



DENDROBIUM AMOENUM.



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ÆRIDES MULTIFLORUM.

2. *Cœlogyne ochracea.* (Plate A.)—An epiphyte which particularly affects oak and rhododendron trees, the latter for choice, and one that grows within a very restricted area of elevation at about 5,500 feet. The whole plant is smaller and more compact than the last species, its pseudobulbs and leaves are much yellower in colour, and the flowers are smaller and are produced on upright stems instead of on drooping ones. The flowers are very sweet scented at times, the scent resembling that of a carnation. When the flowering is over the bottom of the flower stem itself developes into the new pseudobulb with its two lance-shaped leaves, so that in an old plant the flower-stalk bearing one or more seed vessels is seen to be growing out of the top of the pseudobulb instead of from below as is the case with *Cœlogyne cristata.* The flowers are creamy-white, with yellow and ochre markings on the lip.

Season of rest, October to April. Flowering season, throughout May. Season of growth, June to September.

3. *Dendrobium amœnum.* (Plate B.)—On trees of all sorts, between 4,500 and 5,500 feet elevation. The pseudobulbs of this orchid (as of most, if not all, Dendrobiums) are the jointed reed-like stems of the plant itself, which grow to about two feet in length. About April the joints of last year's stems (particularly all the upper ones) will be seen to be swelling, and gradually these swellings will develop into buds, two or three at each joint; and, if the plant be a fine specimen, the splendid show of flowers makes up for the want of leaves, for, unfortunately, this Dendrobium is not evergreen, but drops its leaves annually. Whilst flowering, or just after, the new growth will be observed pushing its way from the base of the flowering stem, and as it grows it throws out small lance-shaped leaves from the joints. The flowers, which measure about two inches across, are white with magenta tips to the petals, sepals and lip, whilst the latter is marked with yellow inside as well. The flowers have a delicious scent of violets. I have never observed this orchid flowering from stems more than one year old, whereas many Dendrobiums go on flowering from old stems for years.

Season of rest, October to April. Flowering season, during May. Season of growth, June to September.

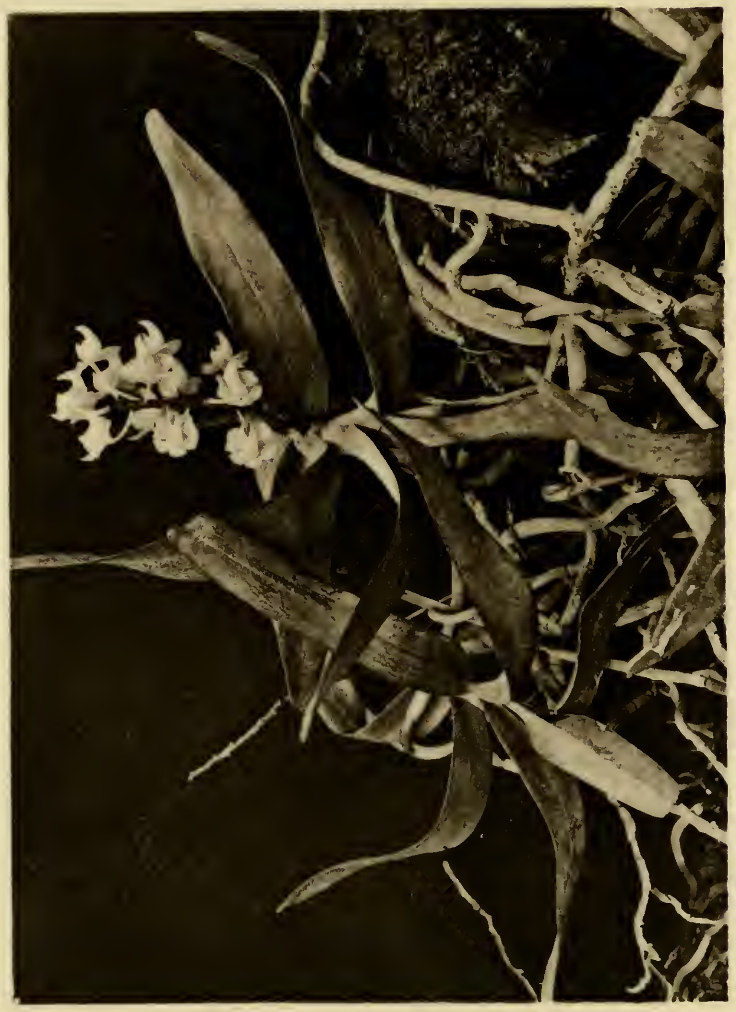
Many Dendrobiums are easily propagated by cutting off an old stem and laying it in moss kept thoroughly damp, thus inducing young plants to be thrown out at some of the joints. When these are sufficiently grown, the old stem is cut away immediately above and below each, and the young plants can then be grown in a pot or on a block of wood with a little moss, or be wired on to a tree; but *Dendrobium amœnum* is very shy of this sort of treatment, though it will occasionally develop young plants.

4. *Ærides multiflorum* (also known as *A. affine.*) (Plate B.)—A compactly growing little plant, living entirely on trees at from 3,000 to 4,500 feet elevation. The general appearance of the plant is a bunch of spotted, brownish, leathery leaves, much curved, channelled, and unevenly dented at the top. From this bunch of leaves the flower stalks hang surrounded by their cylindrical masses of densely packed pretty little rose-coloured flowers. The Ærides have no pseudobulbs on which to depend for nourishment during their season of rest, so one imagines that the fleshy leaves and numerous roots have to answer the purpose. But, curiously enough, these orchids are usually found in dry situations, so it seems probable that a somewhat dry treatment would best suit them.

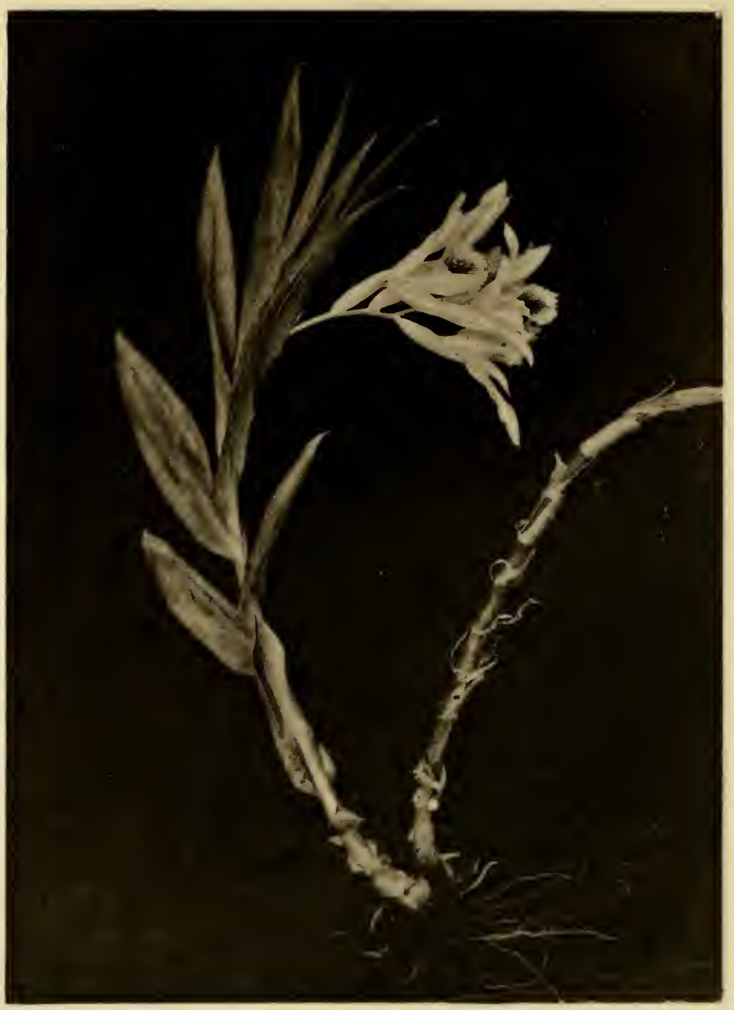
5. *Ærides odoratum.* (Plate C.)—An epiphyte found between 3,000 and 4,500 feet on trees only. Unlike the last species which has numerous, but flat, roots that burrow deep into the moss on the large branches of trees, this orchid is provided with very long, round elastic roots which fasten themselves firmly here and there to the smaller branches on which no moss grows. It is, therefore, much more one's preconceived idea of what an Ærides or "Air Plant" should be.

The flowers are, perhaps, more curious than beautiful, being very fleshy in texture, and are very sweet scented. They are cream-coloured with amethyst shading, and have a curious up-turned spur at the back. When the flower spike first begins to form, it is covered with a gummy substance. The flowers are somewhat variable in their time of appearance, but are usually to be found out in May, June and July. Like all our Himalayan orchids, this species does most of its growing during the rains. Its season of rest may be put down between October and April. With regard to the watering of this genus, as of all orchids which have no pseudobulb, the best rule to go by seems to be never to allow the leaves to shrivel.

6. *Phaius albus.* (Plate C.)—Authorities appear to differ as to the naming of this genus, some adhering to Phaius or Phajus, whilst others



ÆRIDES ODORATUM.



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PHAIUS ALBUS.

insist that it should be Thunia. However, the name here given was received from the late Director of the Botanical Department of Northern India on sending a specimen to be named by him, and this is good enough for an amateur who knows nothing and cares less about the warfare between Phaius and Thunia. These orchids grow both on trees and rocks. They have curved stems up to about two feet in length, thick at the base and tapering to a fine point. These in the young growth are clothed with leaves from top to bottom, the lower ones being small and roundish, while the upper ones are lance-shaped: all are of a slightly bluish tinge, and they all clasp the stem. One of the advantages of this orchid is that its flowers appear on the completion of the new growth and on the same stem as the leaves, which adds much to its beauty. The flowers are very handsome and continue to be thrown out from the end of the stem in succession for a considerable time. They are very large and pure white, except the lip which is marked with yellow on the top and with fine purple lines in the throat. The lip, too, is exquisitely frilled and covered with very fine crystalline hairs. *Phaius albus* has a large range, growing from 3,000 to nearly 6,000 feet above the sea. Season of rest, October to April. Season of growth (during which also they flower), May to September. They usually flower in July and August. It is stated that this is the only orchid from which cuttings can be taken and that it is only necessary to cut up an old stem (at the time when the new growths have fully developed) into equal portions and put them in a pot as though they were ordinary cuttings. But this orchid of its own accord throws out many young plants from the old nearly dried up stems; so all that need be done is to cut off such a stem, tack it on to the bark of a tree, and assist the young roots to take by fastening a little damp moss over them.

Watering.—Wild orchids will always be found in such situations (the rounded branches of trees or steeply sloping rocks) that perfect drainage at their roots is assured. There are of course exceptions or apparent exceptions, such as some of the Cymbidiums which delight in getting their large fleshy roots into a hole containing much decayed matter and holding a considerable amount of moisture; but these orchids are, perhaps, more terrestial than epiphytal in their habits. Others, again, which appear to us to be placed by Nature in very open dry situations, probably receive much more moisture than we imagine from the tremendous drenching dews that fall at night from October to April (the season of rest, be it noted); and these latter orchids will frequently be found to be those for whom Nature has provided no regular reservoirs in the form of pseudobulbs. Looking to all these circumstances, the nearer we can follow Nature, or even go further and assist her by offering additional water in an exceptionally dry season, probably the better our results will be.

Practically all orchids require copious watering during their growing season.

Perhaps it is unnecessary to add that rain water is best, river water next best, and spring water the worst. But the matter is rather an important one.

Copper wire and copper tacks only should be used for wiring orchids on to trees, baskets, tubs, &c., as it does not injure the plants or their roots.

Exporting orchids is a very simple and easy matter, and a few hints may not be out of place here. October and November are quite the best months at all events as far as Himalayan orchids are concerned, for they have stopped growing then and have begun to rest, and even if they arrive at home in frosty weather, it does not seem to affect the hardier kinds. Orchids are more frequently killed than not, and always seriously damaged if packed during their growing season. The plants should be taken from trees and rocks with ordinary care so as not to damage new roots especially, and should then be placed in dry, but shady, situations, where there is plenty of air, to allow of their becoming thoroughly dry. This treatment should last for about a fortnight, and the plants can then be packed tightly with plenty of dry moss (to prevent shaking) into an ordinary wooden case, such as a box to hold a dozen of wine. No air holes are necessary, provided the plants have been well dried. It might be as well to print on the box :—"NOT TO BE STOWED NEAR THE BOILERS." A small lead label, marked with a number, may with advantage be tied on to one specimen of each species packed in the box, and a list containing similar numbers be posted home, under each of which is given the name, locality, habits, and any other information thought needful regarding each kind that has been despatched. Orchids sent home as above recommended sixteen years ago from here are still thriving and flowering splendidly every year.

BIRDS NESTING IN THE MURREE HILLS AND GULLIES.

By Lt.-Colonel R. H. Rattray.

Part I.

(With Plates A and B.)

(*Read before the Bombay Natural History Society on 6th July* 1905.)

The scope of this article is the hills round our Punjab hill station of Murree with an altitude of 6,000 feet to about 7,300, and the neighbouring hills at Changla and Dungagalis. The hills run up to about 9,000 feet near these stations, with a hill, Miranjani, near Dungagalis about 10,000 feet. The hills are for the most part well wooded.

I propose giving an account of two years' nesting in these hills. The illustrations are photographs taken by me on the spot, with the immediate surroundings of the nests as little interfered with as possible.

Oates' and Blanford's numbers are used.

4. Corvus machrorhynchus.—The Jungle-Crow.

Very common in all the hills up to 9,000 feet. Breed freely. All the nests I have seen were on high fir trees.

13. Urocissa flavirostris.—The Yellow-billed Blue Magpie.

These birds are not rare round Murree, but I did not find many nests. The two nests found were slight rough structures, at no height up the trees ; both were on oak trees. Around Dungagalis this was one of the common birds. I took some 14 or 15 nests during May and June. The colour of the eggs is very variable, but the shape very constant, a long narrow egg much pointed at small end.

24. Garrulus lanceolatus.—The Black-throated Jay.

Very common both round Murree and the Galis. Breed as usual during May and June.

26. Garrulus bispecularis.—The Himalayan Jay.

A common bird, but nests difficult to find. At Murree I only took one nest ; this was on 16th June 1903 ; it contained one young one just hatched and 2 hard-set eggs. This year round Changla and Dungagalis I obtained 4 or 5 nests. The nest and eggs are almost indistinguishable from those of last species, but are, as a rule larger.

31. Parus atriceps.—The Indian Grey Tit.

Common, and breed in holes in trees and houses at Murree, but I did not see any on the higher hills round or at the Galis. I do not think they breed above 6,500 feet in these hills.

34. Parus monticola.—The Green-backed Tit.

Very common on all the hills, and breeds everywhere. It is a very familiar bird and nests near houses, often in holes in walls of houses.

35. Ægithaliscus erythrocephalus.—The Red-headed Tit.

Common at Murree, but less so in the higher hills of Changla and Dungagalis. Nests generally in low bushes, but at Murree I once found a nest some 40 feet up in a fir tree, built in a clump of fir cones. I only obtained one nest at Changlagali.

42. Machlolophus xanthogenys.—The Yellow-cheeked Tit.

Rare. I took two nests at Murree and did not see the bird this year round the Galis. This bird is more of a forest bird than the other tits, and always builds in holes in trees. I have never seen them round houses.

44. Lophophanes melanolophus.—The Crested Black Tit.

Rare in Murree, but common in all the higher hills,—one of the commonest birds on Miranjani. Nests in my experience in holes in trees, but at Dungagali I found one nest in a hole in the wall of the house occupied by the Chaplain. It was within 2 feet of a door through which servants were passing in and out all day.

91. Trochalopterum simile.—The Western Variegated Laughing-Thrush.

Very common both round Murree and the Galis up to 10,000 feet. Nests generally about 15 to 20 feet up in a fir tree, often quite at the end of the bough. Eggs generally 3, but I have found 5. I once at Murree found a cuculine egg in a nest of this bird, I think the egg of *Hierococcyx sparverioides*, the Large Hawk-Cuckoo. I also on one occasion found an egg of this bird in a nest of *Rhyacornis fuliginosus*, the Plumbeous Redstart.

99. Trochalopterum lineatum.—The Himalayan Streaked Laughing-Thrush.

I think the commonest bird round Murree and the Galis. This bird is constantly selected by cuckoos to act as foster parent, generally I think by *Cuculus micropterus*.—The Indian Cuckoo. My illustration is of a nest in a low thick bush that looks like a species of Rue, about 3 feet from the ground.

187. Myiophoneus temmincki.—The Himalayan Whistling-Thrush.

Common. Breeds both at Murree and the Galis. Nothing particular to notice about the bird.

191. Larvivora brunnea.—Indian Blue Chat.

Common at Murree, less so in the higher hills. I found one nest high up on Miranjani hill. This bird invariably builds either at roots of bushes or in the sheltered sides of nullahs. It is a shy bird and keeps to thick undergrowth. The male has a shrill loud alarm cry of several notes when its nest is approached; the female sits close. The nest of this bird is very commonly selected by *Cuculus micropterus* to deposit its eggs in. It breeds late. I have found most nests in end of June and beginning of July. Eggs clear deep blue, unspotted or marked.

204. Lioptila capistrata.—The Black-headed Sibia.

Fairly common, nests very hard to find; they are generally high up in a dense fir tree. The nest is a very neat structure and generally placed low down in a bough. Eggs pale blue, in some almost white, spotted and boldly blotched with red marks like dried blood and a few subsidiary markings greyish purple. The birds often give away the nesting site by keeping up a shrill cry. They desert the nest if the tree is climbed, even when the nest is not touched by hand. I have taken nests both at Murree and Dungagali.

226. Zosterops palpebrosa.—The Indian White-Eye.

Common low down round Murree. All nests I have taken were suspended between 2 small twigs in a bush about 3 to 5 feet from the ground. I took two nests in 1904 near Changlagali; one contained five eggs.

237. Pteruthius erythropterus.—The Red-winged Shrike-Tit.

The birds are fairly common round Murree and Dungagali from 7,000 feet upwards, but the nest is, I think, without exception the most difficult to find. It is a strong neat cradle suspended between 2 twigs always high up near top of the tallest trees. During 1903 I found 3 nests—2 on fir trees and one on a tall oak tree; one nest contained 3 eggs. The eggs are peculiar: a broad oval in shape, of a pinkish white, with a mass of claret-coloured spots almost forming a cap round broad end. More like a bulbul's than anything else.

260. Cephalopyrus flammiceps.—The Fire-cap.

This beautiful little bird is rare near Murree, but quite common on the high hills near Galis. I obtained one nest only with young ones at Murree and 5 or 6 nests at Dungagali. The nests are always at least 20 feet up in a small hole in a tree, and unless the bird is seen carrying building materials, is impossible to find. Eggs very fragile, of a very pale blue, 3 or 4 in number.

269. HYPSIPETES PSAROIDES.—The Himalayan Black Bulbul.

Common at Murree, less so at the Galis. Nothing new to remark about nesting habits, etc.

323. SITTA LEUCOPSIS.—The White-cheeked Nuthatch.

Fairly common above 8,000 feet. None near Murree. A common nesting site is high up in a tall fir tree that has been struck by lightning and cracked down the centre ; a convenient place in this crack is selected. Eggs 5 to 8 in number. I obtained seven nests round Dungagali and Miranjani in June. I saw many pairs, but failed to find the nest, as the bird is very cautious in approaching the nest hole.

328. DICRURUS LONGICAUDATUS.—The Indian Ashy Drongo.

Common from Murree to Dungagali. Nests very difficult to get down, as they are generally at the end ot a very thin branch. At Murree I found an egg I attribute to *Surniculus lugubris* in a nest of this bird.

341. CERTHIA HIMALAYANA.—The Himalayan Tree-Creeper.

Very common. I took numerous nests at Murree, Changla and Dungagalis. The nests are generally fairly low down under a piece of bark in a fir tree. Most nests found in May, a few in June. The illustration shows fairly the site of nest which was placed under the bark under the small cross, a few pieces of grass, etc., showing. The tree was a large fir that had been struck and cut down by lightning.

342. CERTHIA HODGSONI.—Hodgson's Tree-Creeper.

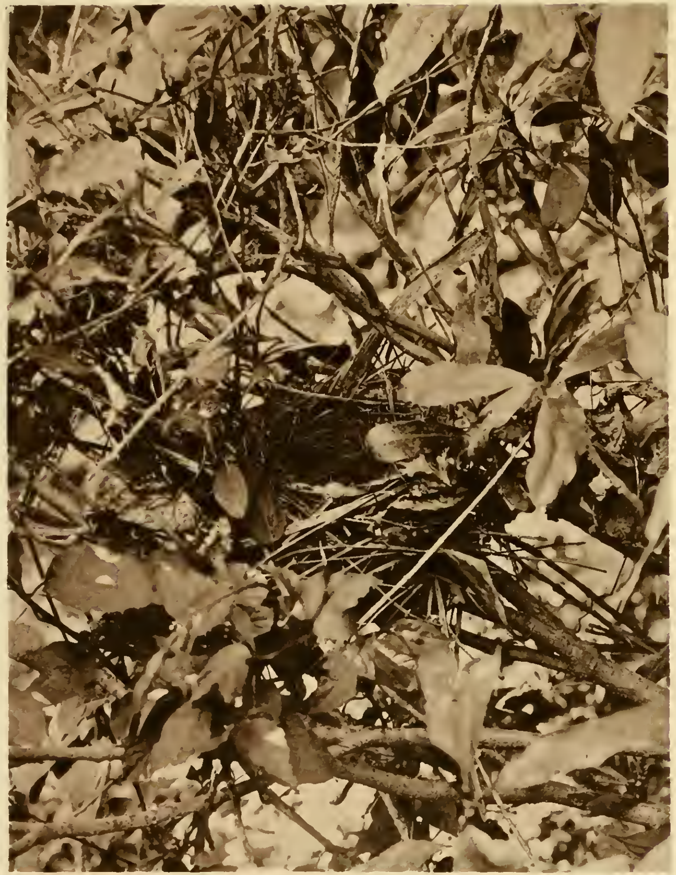
Very rare. I once found a nest with 3 very hard-set eggs on the highest point near Murree, shooting the hen bird off nest. Height about 7,500 feet. This is the only instance in which I have seen the bird, and had I not shot the bird I should have taken it for *C. himalayana.* It is possible birds are missed on this account. The eggs are exactly similar to those of *C. himalayana.*

415. PHYLLOSCOPUS PROREGULUS.—Pallas's Willow-Warbler.

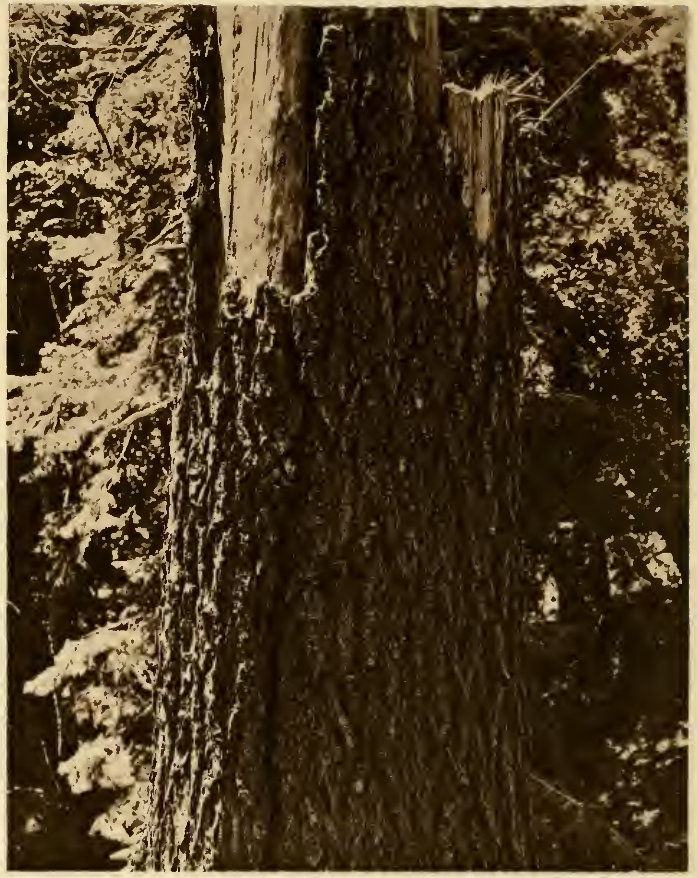
Common and breed freely round Changla, Dungagalis and Miranjani. I took eggs from 6 nests in one week on top of Miranjani from 9,500 feet to 10,000 feet. Nests difficult to find, as the bird is wary and nests are often high up in a fir tree.

418. PHYLLOSCOPUS HUMII.—Hume's Willow-Warbler.

Very rare. I had no idea this bird was found near any of the hills round till I found a nest with 4 much incubated eggs, shooting the hen



NEST OF THE HIMALAYAN STREAKED LAUGHING-THRUSH
(Trochalopterum lineatum)



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NEST OF THE HIMALAYAN TREE-CREEPER.
(Certhia himalayana.)

bird off nest. The bird was a typical *humii.* Nest on the ground near root of a tree and made almost entirely of fine grasses domed over; very neatly lined with very fine grass. No feathers.

422. Acanthopneuste viridanus.—The Greenish Willow-Warbler.

Very rare. It is possible the bird is otten overlooked owing to its general likeness to others of the genus. I found one nest on 1st July 1904, shooting the hen bird off nest myself. The nest was marked down by one of my collectors, so I went with him and took eggs and shot the bird. The eggs looked small for a *magnirostris,* but when I examined the bird I saw I had got a prize. The nest was under the roots of a tree in a cutting, the earth had been washed away leaving a tangle of roots. Nest a mass of moss forming a cup with a neat lining of fine grasses. Eggs 4, slightly incubated and pure white; size about the same as *Acanthopneuste occipitalis.*

424. Acanthopneuste magnirostris.—The Large-billed Willow-Warbler.

Fairly common. This bird was first discovered breeding near Changlagali by Major K. Buchanan. I made a great search with 3 collectors, and between us obtained about 5 nests during the end of June and first half of July. The nests are very difficult to find and all of one type and in similar situations as the last species; all were in a tangle of roots on sides of roads where the earth had been washed away. Nest of moss more or less domed and lined with grasses, but no inner lining of very fine grass. Eggs pure white. I noticed one peculiarity about this bird: generally one egg was laid with a break of a day before the second was laid, then two and sometimes four days passed without a third egg, then 2 more on successive days. I found up to 5 eggs in a nest, but I think 4 the usual number.

428. Acanthopneuste occipitalis.—The Large-crowned Willow-Warbler.

Very common, especially round Murree. Nests in almost any situation. I found them in holes in trees, in banks, in stone walls, under eaves in houses, and under a large stone in a deep ravine. Nest hole almost always lined below and sides, leaving a small hole towards top. I have found 5 eggs of *Cuculus saturatus* and 3 of *Cuculus poliocephalus,* in these birds' nests. On two occasions the nest was the full depth of my arm inside tree stumps.

429. ACANTHOPNEUSTE TROCHILOIDES.—Blyth's Crowned Willow-Warbler.

Not common. I think the nests of these birds are often left undisturbed, being mistaken for last species. I procured 2 nests at Murree in 1903, both in holes in stone walls supporting banks. Nest and eggs similar to last species, but a good deal smaller as a rule.

434. CRYPTOLOPHA XANTHOSCHISTA.—Hodgson's Grey-headed Fly-catcher-Warbler.

Decidedly rare. I have seen very few birds and only once procured eggs, shooting the bird near Changlagali.

458. SUYA CRINIGERA.—The Brown Hill-Warbler.

Quite common I obtained numerous nests at Murree, Changla and Dungagalis.

495. PERICROCOTUS BREVIROSTRIS.—The Short-billed Minivet.

Common everywhere. I obtained nests at Murree, Changla and Dungagalis. I think these are without exception the most beautifully made nests I have ever seen. Always high up in trees and often almost inaccessible. The eggs match nest exactly. Some 7 or 8 nests taken at Murree were on fir trees, one on horse chestnut. At Dungagali I saw 5 nests on a wild cherry tree and 2 on chestnuts and only one on a fir-tree. A few nests had a few feathers as lining. My photographs show two types of nests—one high up on a thin cherry tree, and the other placed on a thin bough of chestnut tree.

505. CAMPOPHAGA MELANOSCHISTA.—The Dark-grey Cuckoo Shrike.

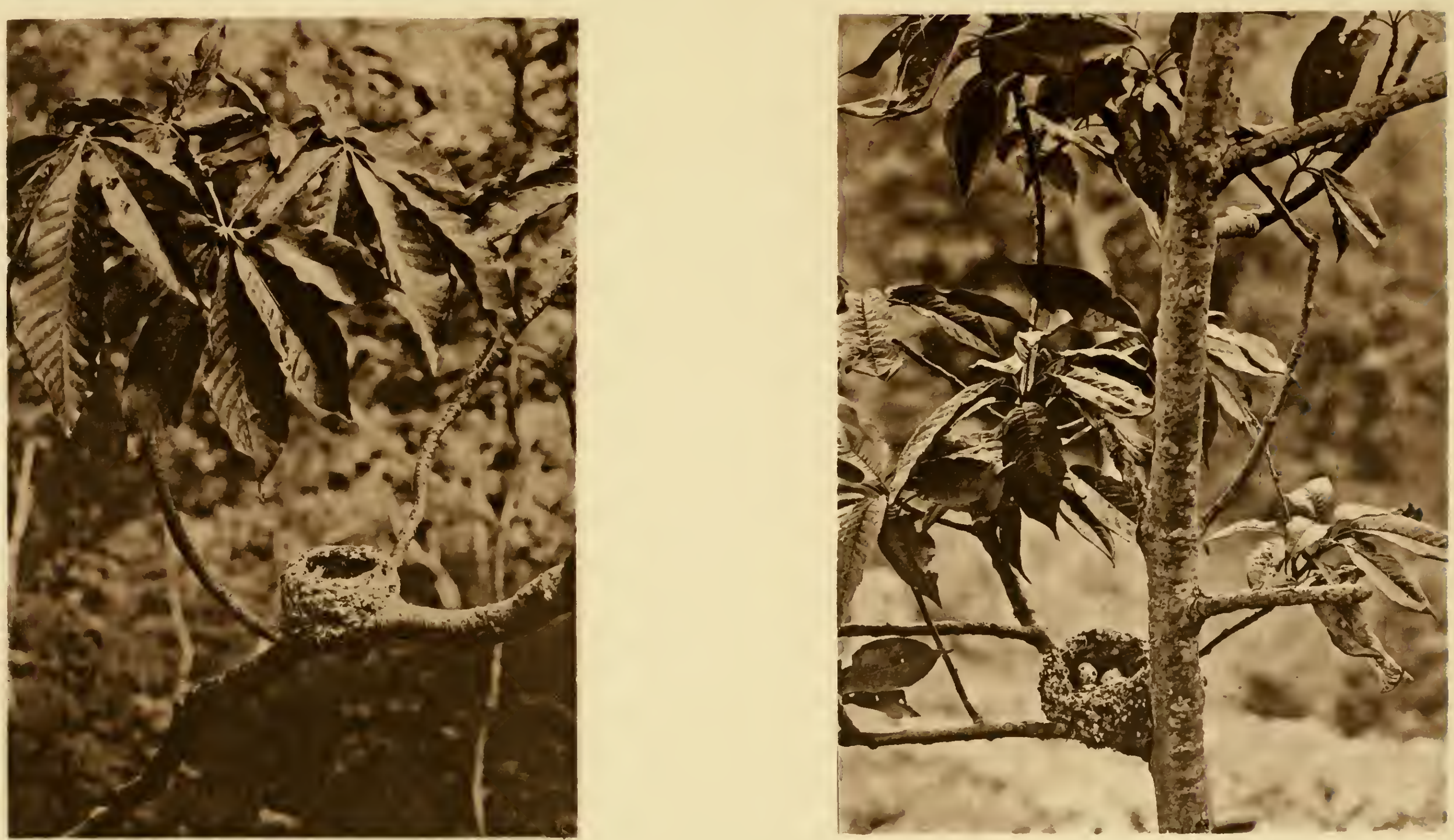
Birds not rare, especially at Murree, but nests very hard to find; they are very small for the bird and always at the top of very high trees. At Murree in 1903 I found 3 nests with young birds in beginning of July. This year, 1904, I procured one nest on 20th May 1904 with one fresh egg.

518. ORIOLUS KUNDOO.—The Indian Oriole.

Common near Murree about 5,500 feet. I saw some nests, but did not take them down.

519. ORIOLUS GALBULA.—The European Oriole.

On 18th June 1903 I found a nest of this bird at Murree with 2 much incubated eggs. There is no doubt about the identity, as I shot the male off nest, and as it seemed different, I shot 3 males of *Oriolus kundoo* and compared them. Nest in a similar situation to *Oriolus kundoo*; one egg had brown spots instead of black.



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NESTS OF THE "SHORT-BILLED MINIVET."
(*Pericrocotus brevirostris.*)

544. TEMENUCHUS PAGODARUM —The Black-headed Myna.

Rare. I obtained one nest, shooting the bird below Dungagali about 5,000 feet elevation. This is the only occasion on which I saw the bird.

549. ACRIDOTHERES TRISTIS.—The Common Myna.

Common all round Murree, but none at Changla or Dungagalis : from this it appears the bird does not ascend the hills above 7.000 ft.

552. ÆTHIOPSAR FUSCUS.– The Jungle Myna.

Common round Murree, but like the last, none at Changla or Dungagalis.

558. HEMICHELIDON SIBIRICA.—The Sooty Flycatcher.

Very rare near Murree, but common above 8,000 feet. I hardly went a day into the higher hills without seeing 2 or 3 pairs. The nests are, however, difficult to find, and situation various, often against side of a tree trunk within reach of the hand, and just as often 40 feet up a fir tree resting on the bough some distance from tree trunk. I obtained some 12 or 13 nests during June and July this year (1904).

568. CYORNIS SUPERCILIARIS.—The White-browed Blue Flycatcher.

Common everywhere. I could have taken any number of nests I wished both at Murree and the Galis.

579. STOPAROLA MELANOPS.—The Verditer Flycatcher.

Very common round Murree, but less so near Changlagali. I saw very few birds near Dungagali.

592. CULICICAPA CEYLONENSIS.—The Grey-headed Flycatcher.

Not common. I saw a few birds round Murree and obtained one nest ; they were not common in the Galis.

594. NILTAVA SUNDARA.—The Rufous-bellied Niltava.

Common round Murree about 6,000 ft., but none at either Changla or Dungagalis. Nests difficult to find. Generally placed in a hole in the bank of shady nullah, but I have found them in a hole in a tree stump and at the roots of bushes. I once found an egg of *Cuculus canorus* in a nest of this bird.

604. RHIPIDURA ALBIFRONTATA.—White-browed Fantail Flycatcher.

I saw 2 or 3 pairs of these birds and am sure from their actions they had a nest near, but as I did not want eggs I did not trouble about the nest.

610. PRATINCOLA MAURA.—The Indian Bush-Chat.

Common round Murree. I obtained a great many nests there. I saw birds near Dungagalis, but did not hunt up their nests.

615. Oreicola ferrea.—The Dark-grey Bush-Chat.

Common round Murree, Changla and Dungagalis. I also saw them near the top of Miranjani, 10,000 ft. Numerous nests and on one occasion an egg of *Cuculus canorus*, the Common Cuckoo, in a nest of this bird.

630. Henicurus maculatus.—The Western Spotted Forktail.

Common round all the hills near water. Eggs taken at Murree, Changla and Dungagali.

637. Microcichla scouleri.—The Little Forktail.

Decidedly rare. I only saw the bird near Changlagali and obtained 3 eggs on point of hatching out. Nest and eggs similar to those described first by me in this Journal and subsequently by Mr. Osmaston.

638. Chimarrhornis leucocephalus.—The White-capped Redstart.

Very rare : one nest was taken by Major K. Buchanan near Changlagali. I did not even see a bird.

646. Rhyacornis fuliginosus.—The Plumbeous Redstart.

None at Murree, but common near every mountain stream round Changla and Dungagalis. I obtained 7 nests this year (1904) during June. Number of eggs vary from 3 to 6 ; general number four.

653. Tarsiger chrysæus.—The Golden Bush-Robin.

Very rare. I only saw one pair near Murree and obtained the nest with 3 fresh eggs and one of *Cuculus micropterus*. My collectors found the nest building and informed me. I went and looked it up some ten days later, and was surprised to see a strange bird leave the nest. I hid myself and shot the hen as she returned to her nest. Nest in a hole in a bank, rather large, made of dead leaves and moss lined with fine grasses. The hole was under a large stone. I failed to shoot the male, but saw him.

657. Adelura cæruleicephala.—The Blue-headed Robin.

Very rare, only found near the top of Miranjani. The nest and eggs were first taken there by Major K. Buchanan, hard set, about end of May. This year we were up during last week of May and found 4 nests with young ones. Nest in a hole in stump of dead tree exactly similar to one described by Wardlaw Ramsay (from Major Buchanan's account). Eggs also agreed with Wardlaw Ramsay's eggs.

(*To be continued.*)

THE ORCHIDS OF THE BOMBAY PRESIDENCY.

By G. A. Gammie, F.L.S.

Part I.

The following descriptions and remarks, unless otherwise duly specified, are not to be taken as altogether of general application to the order in their nature, because they are purposely restricted to illustrate only the orchids found wild in the Presidency.

Orchids of every description are distinguished with facility by the most superficial observers, by a *facies* intuitively recognized, but difficult to define briefly in words. They can be conveniently grouped into two divisions by their manner of growth. The first, *Terrestrial*, comprising those growing with their roots imbedded in the soil and depending upon it for nourishment, as do the majority of flowering plants; the second, *Epiphytic*, consisting of the larger proportion growing on trees, rocks and similar media, but deriving their nourishment, not from their hosts, but solely from the air and moisture. The roots of the latter are usually fully exposed. These are sparse in most, but in some form complicated masses, and they attach themselves firmly to whatever the plant grows on. They have usually a tense, stringy, glaucous appearance, are pale and shrivelled when dry, but plump, green and glistening during the rainy season when viscid drops of liquid often hang from their tips.

In popular language, plants belonging to the first division are familiarly known as Ground Orchids; those of the second are called Orchids *par excellence.*

In the first division also the plants are only visible above ground during the growing and flowering period. Epiphytes, on the other hand, have pseudo bulbs which remain clearly visible all the year round, although they are sometimes devoid of leaves in the dry weather. In these the flowers may be borne by shoots of the previous year which are often leafless, or by growths of the current year but never by either or both indifferently. Orchids are endowed with tenacious vitality, and the life of individual plants, especially when allowed to exist under congenial circumstances, seems to be of unlimited duration. They, however, readily perish under adverse conditions, and where artificially cultivated, success is only ensured when they are favoured with treatment which imitates as closely as possible the details of their natural environment.

Orchids are found in the greatest variety and profusion in tropical and sub-tropical regions possessing a perennially moist atmosphere accompanied by an absence of extreme cold at any season of the year. In India the largest proportion of the order is found in the valleys and plains of the North-eastern frontier and Burma. In the Bombay Presidency the most suitable natural conditions prevail only in the forests of Kanara and the Southern Konkan. Several epiphytic species are found throughout the range of the Ghats and Konkan, but they do not extend beyond the heavy rainfall zone. In the Deccan proper only a few terrestrial species are found, and these only in the vicinity of water.

There is yet another class of orchids, of which we have no representative, termed *Saprophytic,* so called because they derive their nourishment from decaying organic matter. In these the green coloration is absent and their leaves are reduced to *scales* differing but little from the *bracts*, which are the usually small leaf-like bodies subtending the flowers.

From an economical point of view, Orchids are of very trifling importance. Salep is said to be produced from the tubers of some, and the fragrant and aromatic substance called Vanilla is the dried fruit of a species of orchid. From an horticultural standpoint, however, a great number of sorts of orchids are of extreme value on account of the strange forms and beauty of coloration of their flowers, and many publications have been issued dealing with their culture.

In terrestrial orchids the *roots* are invariably swollen and tuberous and are perennial, whilst the part appearing above ground is annual. The leaves either emerge only at the surface of the ground from an arrested underground stem, or they are placed singly at intervals (*alternate*) on a more or less elongated stem.

In epiphytic orchids the stems produced in perennial succession are usually simple but sometimes branched. In the first case they are often bulb-like in form or, if elongate, are more or less thickened. In the second case, where the plants are branched (a rare occurrence) the stems and branches are usually slender. In all cases the term *pseudo-bulb* is usually applied to the stem, whether long or short. The *blades* of the leaves are of the Monocotyledonous type, having longitudinally parallel *nerves* with weak connecting *veins.* They differ, however, from the normal type in possessing a distinct articulation with the stem. They vary in consistence from fleshy or *succulent* to *membranous*. The fleshy leaves are narrowly oblong in shape, with usually an indented apex ; the thinner leaves vary greatly in shape. In position they are always *alternate*, but when they are crowded together this is a difficult point to ascertain. In elongate stems they are usually disposed along two opposite sides of the stem (*distichous* or two-ranked).

The *flowers* are either arranged in *spikes*, i.e., the axis of the flowering branch is undivided and each separate flower has not a distinct stalk, or they are arranged in *racemes*, when each flower has a distinct stalk. These *spikes* or *racemes* are in *panicles* when the main axis, instead of being simple, is divided into two or more separate branches.

When the flowers or the parts bearing them (*inflorescence*) appear to rise directly from or below the surface of the ground, the whole is called a *scape*, and this term is sometimes even applied to the inflorescence of an orchid irrespective of its position.

The part which forms the axis or the separate branches of a compound inflorescence is known as *peduncle* or *rachis ;* the same term is applied to the stalk of a solitary flower when it, of course, forms the sole axis. The stalks of individual flowers are called *pedicels*. When flowers are distinctly stalked they are *pedicellate ;* when the stalks are altogether absent the flowers are *sessile ;* when only the vestige of a stalk is apparent the flower is *subsessile*.

At the base of each flower stalk there is a body, varying from leaf-like to scale-like in form and also varying in colour, called the *bract*.

The *pedicel* or stalk of the flower consists of a long or short actual stalk gradually merging into the clubshaped and grooved body called the *ovary*. This latter ultimately becomes the fruit and it contains an infinite number of minute granules (*ovules*), which are the *seeds* when the fruit developes. If the ovary be cut through transversely it will be found to be hollow with the ovules arranged on definite lines on its inner surface (*placentas*). When the fruit is ripe it bursts into three valves liberating the mass of light, minute, chaffy seeds. As the fruits of orchids are neglected in botanical descriptions no further attention need be directed to them.

Immediately on the top of the ovary (which is thus inferior) is seen what is popularly known as the *flower*. It consists of six external flattened, leaf-like bodies, arranged in two series of three each, called the *perianth*. The three outermost are more or less alike and are known as *sepals.* The two interior and lateral, similar to these, are the *petals*, and the lowermost of this series, which is usually very distinct in shape, is called the *labellum* or *lip.* This often has a sac-like cavity projecting downwards from its base called the *spur*, and its surface usually presents three distinct parts, two projections of varying shapes on the sides called the *lateral lobes* and the terminal or *mid-lobe.* The centre of the lip is often furnished with longitudinal groves or ridges.

The *column* stands in the centre of the flower. This is usually semi-cylindrical and curved and flattened on the side facing the lip. At the top of the column is the *anther,* the loose lid-like part is the *operculum,* and the top of the column itself is sometimes produced into a beak or *rostellum.*.

If the operculum be lifted off carefully with a pin, the *pollinia* or masses of pollen grains may be seen lying within the shallow *anther cells.* These pollen grains may cohere into 1, 2 or 4 pairs of oblong, globose or pear-shaped waxy or glandular masses, which are free from each other or are attached by pairs or fours to a *gland* or a stalk (*caudicle*) may intervene between the pollen masses and gland. (In a Dendrobium, for example, the pollen masses cohere in pairs, each pair in its own anther cell, but they are otherwise quite free, so that, on lifting and removing the operculum, if care be not taken, the pollen masses fall out; in Ærides, on the contrary, on lifting the operculum, the gland will immediately attach itself to the pencil, pin, or whatever instrument is used.)

In front of and just beneath the anther is a viscid cavity called the *stigma.* Fertilisation of the ovules in the ovary is effected by tubes issuing from the pollen passing through the body of the column lengthwise by way of the stigma and thus reaching the ovules.

CLASSIFICATION.

The first division of Bombay Orchids is into *Tribes*, of which there are four. (As this primary classification is based on characters derived from the pollinia it is necessary to use a hand lens to distinguish them correctly.) The following are their chief characters:—

Tribe I. *Epidendreæ.*

Anther cells parallel distinct. *Pollinia* waxy, 1 to 4 in each cell, free, or those of each cell cohering at the base by a viscid appendage.

Tribe II. *Vandeæ.*

Anther cells usually confluent. *Pollinia* waxy, in 2 or 4 united pairs, attached to a gland by a stalk called *caudicle.*

Tribe III. *Neottieæ.*

Anther cells distinct, parallel. *Pollinia* granular or powdery.

Tribe IV. *Ophrydeæ.*

Anther cells parallel or diverging. *Pollinia* in each cell 1, rarely 2, granular, produced below into short tails which are attached to a gland or to a *rostellum.*

In the first two tribes the pollen is waxy. In the first tribe the pollinia are either free from each other, or the separate pairs cohere slightly by viscid threads. In the second tribe the pollinia are arranged in cohering pairs on a stalk which terminates in a gland. In the third and fourth tribes the pollen is granular and powdery. In the former the pollinia are distinct, in the latter they are produced into short tails which are attached to a gland.

(*To be continued.*)

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES III. PART III.

By Sir George Hampson, Bart., F.Z.S., F.E.S.

(*Continued from page* 216 *of this Volume.*)

Sub-family Lithosiana.

Genus Microtana.

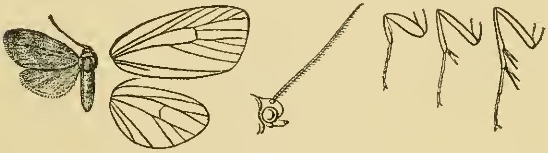
Type.

Microtana, Hmpsn. A.M.N.H. (7) VIII, p. 183 (1901)........... *Fusca.*

Proboscis absent; palpi porrect, slender, not reaching beyond the frons; antennæ of male ciliated, tibiæ with the spurs long. Forewing with the apex rounded; vein 3 from before angle of cell; 4·5 stalked; 6 from upper angle; 7·8·9 stalked, 7 from beyond 9; 10·11 from cell. Hindwing with vein 2 from towards angle of cell; 3·4 stalked; 5 absent; 6·7 stalked; 8 from middle of cell.

1391*c*. Microtana fusca, Hmpsn. A.M.N.H. (7) VIII, p. 183 (1901).

♂. Fuscous brown; abdomen blackish, the anal tuft ochreous. Forewing irrorated with black; the costal area blackish towards base; small black spots in middle and end of cell and beyond its extremity; a blackish patch on costa just beyond middle and another before apex; a terminal series of black points. Hindwing fuscous with indistinct discoidal spot.



Microtana fusca. ♂ $\frac{2}{1}$.

Habitat.—Ceylon, Matele (Pole). *Exp.* 12 mill.

1416*a*. Ovipennis binghami, A.M.N.H. (7) XI, p. 349 (1903) (Pl. D. f. 18).

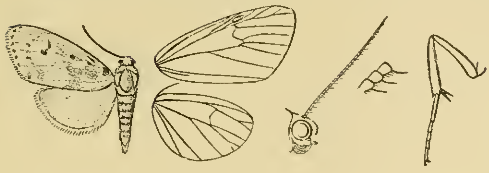
♀. Head and thorax white; palpi at base, antennæ, base of tegulæ and a band across patagia and thorax fuscous; fore and mid legs and extremity of hind tibiæ and tarsi fuscous above; abdomen ochreous with the terminal segments grey, the ventral surface white. Forewing with the basal area orange with obliquely sinuous outer edge; the rest of wing pale reddish brown becoming fuscous towards apex, the margins white. Hindwing fuscous, the inner area pale reddish brown; the cilia white.

Habitat.—Up. Burma, Byingin, 2,500′. *Exp.* 20 mill.

Genus Gymnasura.

Gymnasura, Hmpsn. Cat. Lep. Phal. B.M. II., p. 425 (1900).

Type *G. saginæa* Turner from Queensland.



Gymnasura taprobana ♂ $\frac{2}{1}$.

Proboscis fully developed; palpi porrect not reaching beyond the frons which is somewhat prominent; antennæ of male ciliated: hind tibiæ with the medial spurs absent. Forewing with vein 3 from well before angle of cell; 5 from above angle; 6 from below upper angle; 7·8·9 stalked; 7 from beyond 9: 10·11 free; male with a small postmedial tuft of scales below costa. Hindwing with vein 3·4 on a long stalk, 5 from angle; 6·7 stalked; 8 from towards end of cell; wings thinly scaled.

In the type species from Australia of which the female only is known vein 11 of forewing anastomoses slightly with 12 and veins 3·4 of the hindwing are from the cell.

1419*a*. GYMNASURA TAPROBANA, Hmpsn. A.M.N.H. (7) VIII, p. 184 (1901).

♂. Ochreous; abdomen whitish above except anal tuft. Forewing with a fuscous sub-basal spot on costa; an ill-defined antemedial line excurved below costa and not reaching inner margin; an oblique medial line diffused inwards to the antemedial line at middle and slightly angled inwards in the submedian fold; two points on discocellulars; postmedial, subterminal and terminal series of points. Hindwing with the subcostal area tinged with fuscous; faint traces of a diffused medial line: a discoidal spot; the termen tinged with fuscous.

Habitat.—CEYLON, Matele (Pole). *Exp.* 18 mill.

1426*c*. ASURA DASARA insert (syn.) *Asura undulata*. Swinh. A. M. N. H. (7) XI, p. 501 (1902).

1429*a*. ASURA OBLIQUILINEA, Swinh. A. M. N. H. (7) VII, p. 467 (1901) (Pl. D. f. 19).

♀. Head and thorax orange yellow; vertex of head and shoulders with black points; abdomen greyish dorsally. Forwing orange-yellow; a black point at base; an antemedial series of fuscous points, excurved below costa, then oblique and with points before it above and below median nervure: a medial line, oblique from costa to above vein 1, then bent outwards; a black discoidal point; the postmedial line highly and irregularly dentate; a subterminal series of black points, the one on vein 4 nearer termen. Hindwing pale yellow.

Habitat.—ASSAM, Jaintia Hills, *Exp.* 28 mill.

1439*a*. ASURA DISTICHA transfer to STIGMATOPHORA.

NOLINÆ.

1534*h*. NOLA BRACHYSTRIA, n. sp. (Pl. D. f. 16.)

♂. Antennæ pectinate. Head and thorax grey mixed with brown: palpi blackish at sides; tarsi banded with black; abdomen brownish grey. Forewing grey irrorated with fuscous; very obscure brownish patches at base and middle of costa; an indistinct oblique brown antimedial line from cell to inner margin; an oblique medial line with a black point on it below costa and a short black streak on median nervure between it and antemedial line ; a postmedial series of black points, the point on vein 6 displaced inwards, incurved below vein 4 and bent outwards at vein 1 ; the terminal area rather brown with a grey subterminal line excurved above and below middle ; a terminal series of black points. Hindwing whitish tinged with brown especially towards termen.

♀ Without the black streak on median nervure.

Habitat.—N. KANARA, Karwar (T. R. Bell). *Exp.* 16 mill.

Type—in B. M.

AGARISTIDÆ.

Key to the Genera.

A. Forewing with veins 7·8·9·10 stalked .... *Eusemia.*

B. Forewing with veins 9·10 anastomosing with 8 to form the areole.

- *a.* Frons with truncate prominence with raised rim at extremity........................ *Chelonomorpha.*
- *b.* Frons with rounded prominence
  - a^1 Eyes hairy .... *Exsula.*
  - b^1 Eyes smooth........................ *Scrobigera.*

C. Forewing with vein 9 from 10 anastomosing with 8 to form the areole.

- *a.* Frons with truncate conical prominence with raised rim at extremity.
  - a^1 Palpi with the hair at extremity of 2nd joint long .... *Ægocera.*
  - b^1 Palpi evenly fringed with hair in front .... *Mimeusemia.*
- *b.* Frons with rounded prominence .... *Ophthalmis.*

Genus EUSEMIA.

A. Hindwing orange or red.

- *a.* Patagia without yellow patches.
  - a^1 Hindwing with the terminal band excised and narrow on terminal area .... *Vetula.*
  - b^1 Hindwing with the terminal band expanding greatly on apical area ... .1564 *Latimargo.*
- *b.* Patagia with yellow patches.
  - a^1 Abdomen with the extremity of anal tuft orange ... . *Maculatrix.*
  - b^1 Abdomen with the extremity of anal tuft black *Nipalensis.*

B. Hindwing black usually with orange red spots near tornus

- *a.* Forewing with the subterminal series of spots curved.
  - a^1 Abdomen with dorsal orange bands ; Hindwing with two orange spots above tornus 1561 *Adulatrix.*
  - b^1 Abdomen without dorsal orange bands 1560 *Nigripennis.*
- *b.* Forewing with subterminal series of obliquely placed white points ....1559 *Negrita.*

1566. Eusemia vetula.

The typical form from Java only has the subterminal spots of both wings yellow.

Subsp. 1. *fasciatrix* 1565—*bijugata*, Wlk. Journ. Linn. Soc. Zool. VI, p. 85 (1862)-*communicans-darocana* Druce A. M. N. H. (6), XIV, p. 23 (1894).

Has the subterminal spots of both wings white.

Habitat.—Assam; Malacca; Philippines; Borneo.

Subsp. 2. *communis.*

Has the antemedial and postmedial spots of forewing also white or ochreous white.

Habitat.—Khasis; Cachar.

1563. Eusemia maculatrix, Westw. Nat. Libr. Exot. Moths V, p. 88, pl. 2, f. 3 (1841)-*irenea*, Boisd.

1562. Eusemia nipalensis-*maculatrix*, Westw. Cat. Or. Ent., p. 67, pl. 33, f. 1 (1848) nec Westw. 1841. insert (syn.) *Eusemia westwoodi*, Kirby Allen's Nat. Libr. III, p. 65 (1897).

Genus Chelonomorpha.

1567. Chelonomorpha japona, Motsch. Et. Ent. IX, p. 29 (1860).

Eusemia villicoides, Butl. A. M. N. H. (4) XV, p. 141, pl. 13, f. 2 (1875).

Habitat.—Japan; W. China.

Subsp. 1. Fore coxæ with whitish hair in front; hind coxæ with orange hair, abdomen without lateral, sublateral, and ventral black spots.

Habitat.—Bhurma, Hsipaw.

Subsp. 2 *austeni.*

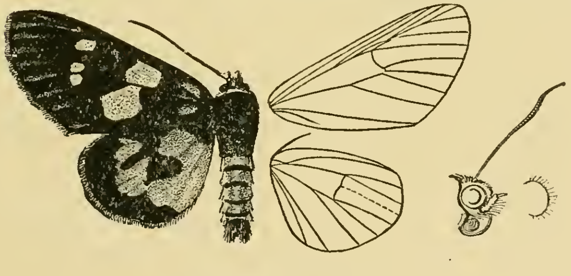
Fore and hind coxæ with orange hair; abdomen with the lateral, sublateral and ventral spots small; hind wing with the spots beyond the cell and on inner area conjoined.

Habitat.—Assam, Khasis.

Genus Exsula.

	Type.
Exsula, Jord. Nov. Zool. III, p. 35 (1896)	*dentatrix*.

Proboscis fully developed; palpi upturned, the 2nd joint fringed with long hair in front, the 3rd well developed, nearly naked and somewhat porrect; frons with slight rounded prominence; eyes somewhat hairy; antennæ almost simple, slightly delated towards extremity. Forewing with vein 2 from long before angle of cell; 3 and 5 from close to angle; 6 from upper angle; 9·10 anastomising with 7·8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsoles-



Exsula dentatrix ♂ $\frac{1}{1}$.

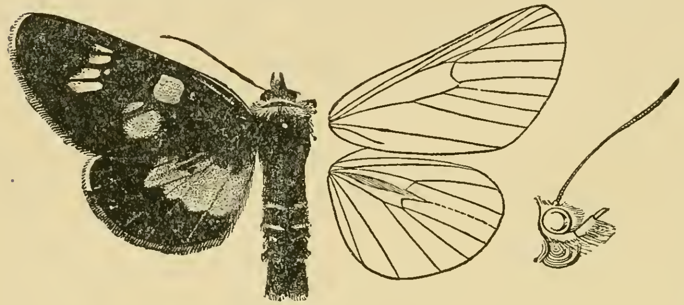
cent from middle of discocellulars ; 6·7 from upper angle ; abdomen of male with protrusible lateral tufts of long hair from 4th segment.

A. Hindwing orange with black discocellular patch and terminal band................. .... 1558 *dentatrix.*
B. Hindwing black with blue terminal band......... 1556 *victrix.*

Genus Scrobigera. *Type.*

Scrobigera, Jord. Nov. Zool. III, p. 37 (1896) ... . *amatrix.*

Proboscis fully developed ; palpi upturned, the 2nd joint fringed with long hair in front, the 3rd well developed ; frons with small rounded prominence ; antennæ almost simple and slightly dilated before apex ; tibiæ nearly smoothly scaled ; claspers of male large and tufted with hair. Forewing with vein 3 from well before ange of cell ; 5 from above angle ; 6 from upper angle ; 9·10 anastomosing with 7·8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars which are angled outwards at its origin; 6·7 from upper angle ; male with a fringe of long black hair on upperside in discal fold, in and beyond end of cell.



Scrobigera amatrix ♂ $\frac{1}{1}$.

A. Hindwing with orange band in both sexes.
  a. Forewing with four yellowish spots beyond the cell .... 1552 *amatrix.*
  b. Forewing with yellowish bar beyond the cell ...1551 *proxima.*
B. Hindwing without orange band in either sex.
  a. Forewing with medial series of yellowish spots and four spots beyond the cell......................1554 *vulcania.*
  b. Forewing without band or spots ....1555 *albomarginata.*

1553. Scrobigera hesperioides, Wlk-*pulchra*, Butl. is from Borneo only.

1555. Scrobigera albomarginata, insert (syn.). *Eusemia candide marginata*, Pouj. Le. Nat. XIII, p. 143 (1891).

Subsp. 1. *flaviciliata*, Boisd. Rev. Zool. (3) ii, p. 104 (1874).

Agarista fimbriata, Boisd. Rev. Zool. (3) ii, pl. 8, f. 1 (1874).

Both wings with the cilia very pale yellow.

Habitat.—Philippines.

Genus Ægocera.

Sect. I. Forewing of male with a well developed groove of ribbed hyaline, membrane below costa beyond middle, a clicking sound being produced during flight probably by friction with the tarsal spines; the veins strongly downcurved.

1577. AEGOCERA TRIPARTITA.

Sect. II. Forewing of male with slight traces of a groove below costa beyond middle, the veins slightly curved downwards.

A. Forewing with wedge shaped fascia beyond the cell ....1578 *venulia.*
B. Forewing with oblique transverse lunulate band beyond the cell ....1579 *bimacula.*

1578. AEGOCERA VENULIA.

Larva 1″. Head smooth glabrous red; body yellow-green irrorated with black; a lateral black stripe with an interrupted pale yellow crenulate line above it; the dorsal area with delicate transverse black striæ and with black suffusion on alternate somites; the penultimate somite with four red tubercles on dorsal area and smaller lateral tubercles; a few short light colored hairs on sides; prolegs red (W. H. Campbell).

Genus MIMEUSEMIA.

A. Abdomen orange with black dorsal patch at base.
  a. Hindwing with the cilia white-tipped ....1584. *albicilia.*
  b. Hindwing with the cilia not white-tipped except at apex ....1583. *ceylonica.*
B. Abdomen banded black and orange.
  a. Abdomen with the two basal segments banded with orange ....1582. *peshwa.*
  b. Abdomen with the two basal segments black.
    *a*¹. Abdomen with black bands on medial segments; hindwing with orange patch on base of inner area usually present ...1581. *basalis.*
    *b*¹. Abdomen without black bands on medial segments; hindwing with creamy patch below the cell ....1581. *a. davidsoni.*
C. Abdomen blackish with the anal tuft orange .. ...1580. *accurata.*

Genus OPHTHALMIS.

Type.

Ophthalmis, Hübn. Verz., p. 166 (1827) .... *lincea.*

Pristoceræa, Karsch. Ent. Nachr xxi, p. 349 (1895) .... *eriopis.*

Proboscis fully developed; palpi upturned, the 2nd joint roughly scaled in front, the 3rd long, naked, and somewhat porrect; frons with rounded prominence; antennæ almost simple, slightly dilated towards extremity; pectus and tibiæ nearly smoothly scaled; abdomen with slight dorsal ridges of hair or smoothly scaled, the claspers of male large, protrusible lateral tufts of long hair from base. Forewing with veins 3·4 from angle of cell; 5 from above angle; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with vein 2 from well before angle of cell, 3·4 from angle; 5 obsolescent from middle of discocellulars; 6·7 from upper angle.

1568. OPHTHALMIS FUNEBRIS.

Subsp. 1 *Vitheroides.* Leach. Entom. xxiii, p. 110 (1890); Oberth. Et. Ent. xvi, p. 8, pl. 1, f. 4.

Forewing with the white markings larger, the spot in middle of cell triangular; the bluish markings at base, in submedian interspace, and the postmedial and subterminal series more developed. Hindwing with a black discoidal band separating the spot beyond the cell from the white patch in cell.

Habitat.—W. CHINA. *Exp.* ♂ 72 ♀ 80 mill.

The genus ZALISSA belongs to the *Noctuidæ.*

Family NOCTUIDÆ.

Key to the sub-families.

A. Maxillary palpi absent.
  a. Hindwing with vein 5 obsolescent from or from just below middle of discocellulars.
    a^1. Mid and hind tibiæ, or hind tibiæ only, spined... *Agrotinæ.*
    b^1. Mid and hind tibiæ not spined.
      a^2. Eyes hairy .... *Hadeninæ.*
      b^2. Eyes not hairy.
        a^3. Eyes with long overhanging cilia .... *Cuculllianæ.*
        b^3. Eyes not ciliated .... *Acronyctinæ.*
  b. Hindwing with vein 5 well developed.
    a^1. Palpi with the 3rd joint blunt.
      a^1. Frenulum of female simple.
        a^3. Abdomen with lateral anal pencils of hair... *Euteliancæ.*
        b^3. Abdomen without anal pencils of hair; forewing with tufts of raised scales in cell .... *Stictopterinæ.*
      b^2. Frenulum of female multiple.
        a^2. Retinaculum of male bar-shaped.
          a^4. Forewing with tufts of raised scales in cell .... *Sarrothripinæ.*
          b^4. Forewing without tufts of raised scales in cell .... *Acontianæ.*
        b^3. Retinaculum of male not bar-shaped.
          a^4. Mid tibiæ spined .... *Catocalinæ.*
          b^4. Mid tibiæ not spined.
            a^5. Eyes hairy .... *Mominæ.*
            b^5. Eyes not hairy.
              a^6. Eyes with long overhanging cilia ... *Plusianæ.*
              b^6. Eyes not ciliated.
                a^7. Hindwing with vein 5 from close to angle of cell, strong............ *Noctuinæ.*

b^7. Hindwing with vein 5 from well above angle of cell, rather weak .... *Erastrianæ.*

b^1. Palpi with the 3rd joint acuminate .... *Hypeninæ.*

B. Maxillary palpi present .... *Hyblæinæ.*

Sub-family AGROTINÆ.

Proboscis usually well developed, sometimes aborted ; palpi usually short, upturned or porrect ; frons rounded, often with rounded prominence, sometimes with corneous plate below it, or with corneous processes of various forms ; eyes naked, sometimes overhung by cilia, in *Trichanarta* hairy : antennæ usually ciliated, often pectinate or serrate ; head and thorax clothed with hair and scales when there are usually crests on pro-and meta-thorax or ridge-like dorsal crest, or clothed with hair only ; tibiæ more or less spinose, all the tibiæ being usually strongly spined, in others the spines are reduced to one between mid and terminal spurs of hind tibiæ ; abdomen rarely with dorsal crests. Wings usually broad, sometimes rather narrow, the termen rounded or crenulate ; forewing with vein 1 a. weak, not anastomosing with 1 b. ; 1 c. absent ; 2 from middle of cell ; 3 and 5 from near lower angle ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole, 7 from the areole : 11 from cell. Hindwing with veins 1 a. and b present, 1 c. absent ; 3·4 from lower angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle or shortly stalked ; 8 arising free, then bent down and touching the cell, then again diverging.

Larva.—Smooth, the warts with one hair ; all the prolegs present, the 12th somite with dorsal hump. In the *Heliothis* group they usually feed on flowers ; in the *Agrotis* group they often hide in the earth by day and emerge to feed at night ; the perfect insect of the former often flying in the sunshine, whilst the latter are purely nocturnal.

Pupa buried in the earth, of which it forms an agglutinated cocoon.

Key to the Genera.

A. Fore tibiæ with spines or claws.
  a. Frons with prominence.
    a^1. Frontal prominence rounded in front.
      a^2. Frons with corneous plate below the prominence.
        a^3. Fore tibiæ spined at sides .... *Melicleptria.*
        b^3. Fore tibiæ not spined at sides.
          a^4. Forewing rather short and broad, the apex rounded .... *Raghuva.*
          b^4. Forewing rather long and narrow, the apex somewhat produced .... *Timora.*
      b^2. Frons without corneous plate below the prominence .... *Chloridea.*
    b^1. Frons with truncate conical prominence.
      a^2. Eyes small and reniform.............................. *Orosagrotis.*

- b^2. Eyes large, rounded.
  - a^3. Fore tibiæ short with three long claws on inner side at extremity and short claws on outer side .... *Micragrotis.*
  - b^3. Fore tibiæ spined and without claws .... *Euxoa.*
- c^1. Frons with slight vertical ridge .... *Feltia.*
- b. Frons without prominence.
  - a^1. Head and thorax clothed with hair only .... *Episilia.*
  - b^1. Head and thorax clothed with hair and scales and with more or less developed thoracic crests.
    - a^2. Prothorax with ridge like crest .... *Richia.*
    - b^2. Prothorax with spreading crest.
      - a^3. Abdomen dorsally rather flattened.
        - a^4. Forewing narrow, the margins subparallel .... *Hermonassa.*
        - b^4. Forewing broad, triangular .... *Agrotis.*
      - b^3. Abdomen not dorsally flattened .... *Lycophotia.*

- B. Fore tibiæ, without spines or claws.
  - a. Eyes hairy.
    - a^1. Eyes small, reniform.................................. ..... *Trichanarta.*
    - b^1. Eyes large, rounded.................................... *Tricheurois.*
  - b. Eyes not hairy.
    - a^1. Frons with rounded prominence with corneous plate below it.. *Adisura.*
    - b^1. Frons obliquely rounded, with slight roughened prominence at extremity .... *Neurois.*
    - c^1. Frons smooth.
      - a^2. Mid tibiæ spined.
        - a^3. Eyes ciliated; thorax clothed with hair only.
          - a^4. Palpi long, upturned, the 3rd joint porrect *Paraxestia.*
          - b^4. Palpi short, oblique .... *Isochlora.*
        - b^3. Eyes not ciliated.
          - a^4. Head and thorax clothed with hair only. *Mythimna.*
          - b^4. Head and thorax clothed with hair and scales.
            - a^5. Abdomen dorsally flattened.
              - a^6. Palpi with the 3rd joint long and naked .... *Epilecta.*
              - b^6. Palpi with the 3rd joint short and slightly hairy below .... *Triphæna.*
            - b^5. Abdomen not dorsally flattened .... *Eurois.*
      - b^2. Mid tibiæ not spined......................... .. .. *Protagrotis.*

Genus TRICHANARTA.

	Type.
Ala, Stand. Stett. Ent. Zeit, 1882, p. 49 (nec. Loch. Gust. 1877)	*picteti.*
Trichanarta, Hmpsn. Moths, Ind., iv, p. 507 (1896)	*ladacensis.*

Sect. II. (*Trichanarta*). Antennæ of male ciliated.

1619,*a*. TRICHANARTA LADACENSIS.

Genus RAGHUVA.

A. Forewing with dentate postmedial line .... *perdentata.*

B. Forewing with postmedial series of black points.

  a. Forewing with discoidal spot, no fuscous fascia on medial nervure .... *confertissima.*

  b. Forewing without discoidal spot, a fuscous fascia on medial nervure and vein 4 .... *perstriata.*

1619*b*. RAGHUVA PERDENTATA, Hmpsn. Cat. Lep. Phal. B. M., iv, p. 30, pl. 55, f. 11 (1903).

♂. Head and thorax ochreous mixed with black ; abdomen ochreous. Forewing ochreous, suffused with rufous along median nervure, between veins 2 and 5 and beyond the postmedial line ; a highly dentate fuscous antemedial line ; orbicular small, round, whitish with fuscous outline and centre ; reniform fuscous, with irregular outline ; the postmedial line strongly bent outwards below costa, then highly dentate, excurved to vein 4, then oblique and defined by white on outer side ; some pale and black marks on apical part of costa and a terminal series of small black lunules ; cilia fuscous with a pale line through them. Hindwing ochreous white with ill-defined fuscous postmedial line between veins 4 and 2, and slight dentate brown terminal marks on the veins towards apex. Underside of forewing with the reniform black, a curved fuscous postmedial band.

♀. Hindwing with the terminal area suffused with fuscous.

Habitat.—BR. E. AFRICA, Kikuyu ; BURMA, Myingyan. *Exp.* 22-24 mill.

1619. RAGHUVA CONFERTISSIMA.

1619*c*. RAGHUVA PERSTRIATA, Hmpsn. Cat. Lep. Phal. B. M. iv, p. 32, pl. 55, f. 14 (1903).

♂. Head and thorax ochreous tinged with brown ; abdomen ochreous. Forewing ochreous ; an obscure diffused fuscous fascia along median nervure and above vein 4 to termen ; antemedial black points on median nervure and vein 1 ; a curved postmedial series of black points on the veins ; a minute black streak on costa before apex and a terminal series of points. Hindwing ochreous.

Habitat.—PUNJAB, Kangra. *Exp.* 30 mill.

Genus CHLORIDEA.

	Type.
Chloridea, Westw. Jardine's Nat. Lebr. xxxvii. p. 198 (1841)	*virescens.*
Aspila, Guen. Noct. II., p. 174 (1852)	*virescens.*
Heliocheilus.—Grote, Proc. Ent. Soc. Phil., iv, p. 328 (1865)	*paradoxa.*
Heliothis, Hübn. Tent ined.	*dipsacea.*

Proboscis fully developed ; palpi oblique, fringed with rough hair in front and extending to just beyond frons, which has a rounded prominence ; eyes large, rounded ; antennæ ciliated ; head and thorax smoothly clothed with hair and scales ; fore tibiæ spined at sides and with slender apical pair of claws ; mid and hind tibiæ spined ; abdomen smoothly scaled. Forewing with vein 3 from near angle of cell ; 5 from above angle ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle.

Sect. I. (*Heliocheilus*). Forewing of male with the costa dilated and thickened at middle with an elliptical patch of ribbed hyaline membrane below it and a more elongate patch in the cell ; the subcostal nervure bent downwards and the veins from its extremity distorted.

A. Hindwing with black fasciæ in submedian fold and on inner margin .... *translucens.*
B. Hindwing without black fasciæ in submedian fold and on inner margin .... *hyalosticta.*

1605. CHLORIDEA TRANSLUCENS.

1605. *a.* CHLORIDEA HYALOSTICTA.

Sect. II. (*Chloridea*). Forewing of male normal.

A. Hindwing with large black discoidal spot.................. *dipsacea.*
B. Hindwing without large black discoidal spot.
  a. Forewing with subterminal black point above tornus.
    *a*¹ Forewing with prominent dark marks on costa above reniform and at postmedial band......... *peltigera.*
    *b*¹ Forewing without prominent dark marks on costa. *nubigera.*
  b. Forewing without subterminal black point above tornus.
    *a*¹ Forewing with the postmedial line indistinct and strongly dentate .... *obsoleta.*
    *b*¹ Forewing with the postmedial line distinct, double, and hardly dentate .... *assulta.*

1601. *a.* CHLORIDEA DIPSACEA, Linn. Syst. Nat., xii, p. 856 (1766). Esp. Schmett., pl. 172, ff 1-3 ; Hübn. Samml. Eur. Schmett Noct. f. 311 ; Dup. Lep. Fr., vii, pl. 119, f. 2.

Heliothis maritima, Grasl. Ann. Soc. Ent. Fr. 1855, p. 68, pl. 7.
„ *spergulariæ*, Led. Noct. Eur. p. 230 (1857).
„ *adaucta*, Butl. Ill. Het., B.M. III., p. 19, pl. 45, f. 4 (1878).

Head and thorax pale-brownish tinged with olive ; abdomen olive-grey irrorated with black, thickly on dorsal surface, the anal tuft tinged with rufous. Forewing pale olive-grey ; the sub-basal line represented by black points below costa and cell ; an indistinct irregularly dentate antemedial line ; the orbicular usually represented by three black points in the form of a triangle ; reniform indistinct dusky or prominently black with black points round its edge; an indistinct dentate medial line from cell to inner margin often with an oblique shade on its inner edge to the antemedial line at inner margin; the postmedial line indistinct, dentate, with black points on the veins at extremity of teeth, bent outwards below costa, angled inwards above vein 5 and incurved below vein 3; a brown band between the postmedial and subterminal lines below vein 3 extending to the medial line; the subterminal line pale with dark mark on its inner side at costa, and points on the veins, slightly angled outwards at vein 7 and incurved below vein 3; a terminal series of black points or spots. Hindwing ochreous white; the inner and costal areas suffused with black; a large black discoidal spot; the terminal area black, its inner edge angled outwards at veins 4 and 1 and incurved between those points; a bidentate pale subcostal patch between veins 2 and 4; cilia white with fuscous line at base towards apex. Underside whitish; forewing with the basal half of inner area, the orbicular, reniform and postmedial band black; hindwing with the markings of underside showing indistinctly through.

Habitat.—EUROPE; CANARIES; SYRIA; E. TURKISTAN; AMURLAND; JAPAN; CHINA; PUNJAB, Hunza, Kashmir, Sinde Valley, Dras. *Exp.* 26-38. mill.

1602. CHLORIDEA PELTIGERA.

1603. CHLORIDEA NUBIGERA.

1601. CHLORIDEA OBSOLETA, Fabr. Ent. Syst. 3.1, p. 456 (1793).
Noctua armigera, Hübn. Samml. Eur. Schmett, Noct., f. 370 (1827).
Heliothis pulverosa, Wlk., xi, 688 (1857).
„ *conferta*, Wlk., xi, 690 (1857).
Thalpophila rubrescens, Wlk., xv, 1682 (1858).
Heliothis uniformis, Wllgrn. Wien. Ent. Mon, iv, p. 171 (1860).
„ *punctigera*, Wllgrn. Wien Ent. Mon, iv, p. 171 (1860).
„ *umbrosus*, Grote. Proc. Ent. Soc. Phil., i, p. 219 (1863).

1601. *b* CHLORIDEA ASSULTA, Guen. Noct. II, p. 178 (1852).
Heliothis temperata, Wlk, xi, 689 (1857).
„ *separata*, Wlk, xi, 691 (1857).
„ *succinea*, Moore, P. Z. S., 1881, p. 362.

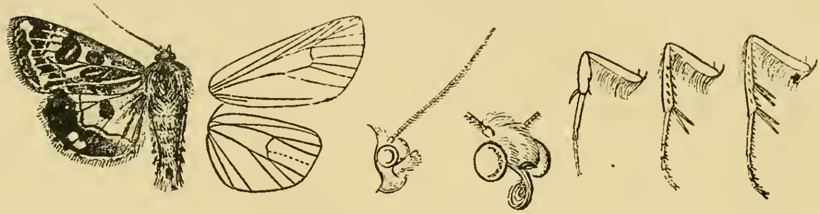
Head and thorax orange tinged with red-brown; fore tibiæ brown above; abdomen orange; forewing orange tinged with red-brown, the veins rufous; a double curved sub-basal line from costa to submedian fold; the antemedial line double, strongly waved, the inner line indistinct; orbicular and reniform with dark centres and brown outlines, the former round; the medial line oblique from costa to median nervure where it is angled, then incurved; the postmedial line double, bent outwards below costa, slightly incurved at discal fold, incurved below vein 4 and with its inner line minutely waved and slightly angled outwards at vein 1, the area beyond it brownish to the subterminal line which is angled outwards at vein 7, dentate inwards to the postmedial line at veins and outwards to termen at veins 4. 3. 2: cilia rufous. Hindwing orange-yellow; the terminal area broadly black with somewhat sinuous inner edge with postmedial line just before it between veins 6 and 2. Underside of forewing with the orbicular and reniform black; both wings with blackish band beyond the postmedial line except on inner area of forewing and costal area of hindwing.

Habitat.—W. AFRICA; JAPAN; COREA; CHINA; FORMOSA; PUNJAB Kulu, Sultanpur, Allahabad; BHUTAN; BOMBAY; CEYLON; BURMA, Hsipaw; JAVA; AUSTRALIA; SAMOA; TAHITI; *Exp.* 24-36 mill.

Larva, Hmpsn. Ill. Het. B. M. ix, p. 92, Pl. 176, f. 22.

Genus MELICLEPTRIA.

	Type.
Melicleptria.—Hübn. Verz., p. 262 (1827)	*scutosa.*
Canthylidia.—Butl Trans. Ent. Soc., 1886, p. 406	*pallida.*



Melicleptria scutosa, ♂ $\frac{1}{1}$

Proboscis fully developed; palpi obliquely porrect to just beyond frons, and slightly fringed with hair below; frons with rounded prominence with corneous plate below it; eyes large rounded; antennæ of male ciliated; head and thorax smoothly clothed with hair and scales; fore tibiæ short and broad with long curved claw and two spines on inner side and shorter claw or spine on outer; mid and hind tibiæ spined. Forewing with veins 3 and 5 from close to angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 4 from cell. Hindwing with veins 3·4 from angle of cell 5 obsolescent from middle of discocellulars; 6·7 from upper angle.

Sect. II, (*Melicleptria*). Forewing of male without glandular swelling on costa.

1604. MELICLEPTRIA SCUTOSA.

Genus TIMORA.

	Type.
Timora, Wlk., ix, 132 (1856)	*senegalensis.*
Sophaga, Moore, P. Z. S., 1881, p. 362	*sinuata.*
Dorika, Moore. P. Z. S., 1881, p. 363	*sanguinolenta.*
Masalia, Moore, P. Z. S., 1881, p. 364	*radiata.*
Pradatta, Moore, P. Z. S., 1881, p. 364	*beatrix.*
Carubasa, Moore, P. Z. S., 1881, p. 866	*lanceolata.*
Rhodosea, Grote Can. Ent. xv., p. 4 (1883)	*julia.*

Proboscis fully developed; palpi porrect to just beyond frons and fringed with hair below; frons with rounded prominence with corneous plate below it; eyes large, rounded; antennæ of male ciliated; head and thorax clothed with hair and scales; fore tibiæ short and broad, with long curved claw on inner side and short claw on outer; mid and hind tibiæ spined; abdomen smoothly scaled. Forewing rather narrow, the apex somewhat produced; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole, which is long and narrow; 11 from cell. Hindwing with veins 3·4 from angle of cell, rarely stalked; 5 obsolescent from middle of discocellulars; 6·7 from upper angle.

Sect. II. Forewing of male without glandular swelling on costa.

A. Hindwing of male with veins 3·4 stalked.

1618. Timora dora.

B. Hindwing of male with veins 3·4 from cell.

a. Forewing with oblique postmedial pink band with white points on it ... ... *decorata.*

b. Forewing without postmedial pink band with white points on it.

a^1. Forewing with terminal series of black points.

a^2. Forewing with dentate postmedial line. *sinuata.*

b^2. Forewing with curved postmedial series of points ... ... *aureola.*

b^1. Forewing without terminal series of black points.

a^2. Forewing with curved postmedial series of points.

a^3. Forewing not irrorated with black.

a^4. Forewing golden yellow with fiery red streaks on the veins .... *sanguinolenta.*

b^4. Forewing yellowish, the costal area tinged with pink, the inner area with fuscous .... *uncta.*

b^3 Forewing irrorated with black .... *irrorata.*

b^2 Forewing without postmedial series of points.

a^3 Forewing with black point at upper angle of cell .... *bimaculata.*

b^3 Forewing without black point at upper angle of cell.

a^4 Forewing with prominent black fascia on median nervure .... *nigristriata.*

b^4 Forewing without prominent black fascia on median nervure.

a^5 Forewing with well-defined pink fasciæ on costal and inner areas.

a^6 Forewing with the costal fascia broad.. *lanceolata*

b^6 Forewing with the costal fascia narrow .... *cruentata.*

b^5 Forewing without well-defined pink fasciæ on costal and inner areas.

  a^6 Forewing with white fascia in discal fold.

    a^7 Forewing with the ground-colour ochreous .... *flavia.*

    b^7 Forewing with the ground-colour chestnut .... *bivittata.*

    c^7 Forewing with the ground-colour flesh-red .... *terracotta.*

    d^7 Forewing with the ground-colour rose pink.

      a^8 Forewing with the inner area not suffused with fuscous .... *beatrix.*

      b^8 Forewing with the inner area suffused with fuscous.................. *radiata.*

  b^6 Forewing with yellowish fascia in discal fold ....

    a^7 Forewing with the inner area suffused with fuscous.

      a^8 Forewing with the cilia wholly pink. *metaphæa.*

      b^8 Forewing with the cilia white-tipped except at apex and tornus ... . *tosta.*

      c^8 Forewing with the cilia wholly white-tipped .... *albicilia.*

    b^7 Forewing with inner area not suffused with fuscous .... *modesta.*

  c^6 Forewing without fascia in discal fold.

    a^7 Forewing ochreous .... *artaxoides.*

    b^7 Forewing white .... *hololeuca.*

1608. TIMORA DECORATA.

1611. TIMORA SINUATA.

1613. TIMORA AUREOLA.

1610. TIMORA SANGUINOLENTA.

1614. TIMORA UNCTA.

1615. TIMORA IRRORATA.

1616. TIMORA BIMACULATA.

1616*a*. TIMORA NIGRISTRIATA, Hmpsn. Cat. Lep. Phal. B. M. iv, p. 110, pl. 58, f. 2 (1903).

♂. Head and thorax pale dull brown; antennæ and abdomen whitish. Forewing pale rose-pink; a black streak on median nervure extending to just beyond the cell; a broad yellowish-white fascia below the cell extending beyond the cell to vein 4; a yellowish-white streak in discal fold from middle of cell to termen and a slight streak above veins 6·7. Hindwing whitish, the terminal half tinged with fuscous brown. Underside of forewing suffused with fuscous. *Habitat.*—MADRAS, Belgaum. *Exp.* 30 mill.

1607. TIMORA LANCEOLATA.

Adisura splendens, Druce, P. Z. S., 1887, p. 685.

Adisuraimitata, Druce, Biol. Centr. Am. Het. 1, p. 301, pl. 38, f. 6 (1889).

1607*a.* TIMORA CRUENTATA, Moore, P. Z. S., 1881, p. 367; Butl. Ill. Het. B. M. vii., pl. 130, f. 9.

Curubasa marginata, Moore P. Z. S., 1881, p. 367.

Head and tegulæ ochreous tinged with brown; antennæ whitish; thorax whitish, slightly tinged with pink; abdomen ochreous. Forewing straw-yellow; the costal and inner areas purplish pink, the inner area more or less strongly suffused with fuscous; cilia often pink or tinged with pink at tips. Hindwing straw-yellow, often more or less strongly tinged with fuscous. Underside of forewing often suffused with fuscous towards base.

Habitat.—PUNJAB, Sultanpore, Kala Pani, Simla, Dharmsala. *Exp.* 26-30 mill.

1607*b.* TIMORA FLAVIA, Hmpsn. Cat. Lep. Phal. B. M. iv., p. 113, pl. 58, f. 9 (1903).

Head and thorax ochreous tinged with brown; abdomen ochreous. Forewing ochreous; the subcostal and median nervures and nervules streaked with pink; a white fascia in discal fold from middle of cell to near termen with a slight fuscous streak below it on vein 5. Hindwing ochreous white. Underside of forewing with diffused fuscous streaks on the veins.

Habitat.—BOMBAY, Mhow, Deccan; MADRAS Belgaum, Wynâd. *Exp.* ♂ 24, ♀ 26 mill.

1609. TIMORA BIVITTATA.

1607. TIMORA TERRACOTTA, Hmpsn. Ill. Het. B. M., VIII., p. 71, pl. 144, f. 22 (1891).

Head and thorax dull brown, the metathorax pinkish: abdomen ochreous. Forewing deep flesh-red; a yellowish streak in basal half of submedian fold; a white fascia in discal fold from middle of cell to termen, defined above and below by fuscous streaks; the veins of terminal area slightly streaked with white. Hindwing white, tinged with fuscous except towards base, and in female slightly with pink. Underside of forewing fuscous, the marginal areas pinkish.

Habitat.—NILGIRIS; TRAVANCORE, Pirmád. *Exp.* 30 mill.

1612. TIMORA BEATRIX.

1612*a.* TIMORA RADIATA, Moore, P. Z. S., 1881, p. 364. Hmpsn., Cat. Lep. Phal. B M., IV., p. 114, pl. 58, f. 14.

♂. Head and thorax pale brownish, tinged with pink; abdomen ochreous, suffused with brown, the ventral surface whitish. Forewing dull pink, the inner half suffused with brown; the costal edge whitish; a white fascia through the cell to termen, attenuate at extremities; a white fascia in basal half of submedian fold; the veins of terminal area streaked with white; cilia whitish and pink. Hindwing fuscous brown, the cilia mixed with white. Underside of forewing with the ground-colour fuscous.

Habitat.—PUNJAB, Manpuri. *Exp.* 24 mill.

1612*b*. TIMORA METAPHÆA, Hmpsn., Cat. Lep. Phal. B. M., IV., p. 115, pl. 58, f. 16 (1903).

♀. Head and thorax dull brown, the latter tinged with pink; abdomen ochreous, dorsally tinged with fuscous. Forewing purplish-pink, the inner area suffused with fuscous; traces of a pale fascia in discal fold from middle of cell to near termen. Hindwing fuscous brown; the termen pinkish; the cilia pink at base, whitish at tips. Underside of forewing fuscous except marginal areas which are ochreous tinged with pink.

Habitat.—BELOOCHISTAN; PUNJAB, Mandi. *Exp.* 28—30 mill.

1612*c*. TIMORA TOSTA, Moore, P. Z. S., 1888, p. 411. Hmpsn. Cat. Lep. Phal. B. M., IV., p. 115, pl. 58. f. 17.

Head and thorax pale yellow-brown, metathorax and legs tinged with pink; abdomen ochreous white. Forewing with the apex somewhat produced and acute, pink thickly irrorated with darker red; the costal edge pale; traces of a pale fascia below base of cell; a pale fascia in discal fold from middle of cell to towards termen, narrowing to a point at extremities; a terminal series of slight dark points; cilia white-tipped, except at apex and towards tornus. Hindwing yellowish-white, the median nervules and termen in female slightly suffused with pink. Underside of both wings pale ochreous, the costa and termen tinged with red.

Habitat.—PUNJAB, Kulu, Sultanpore, Dharmsála. *Exp.* 34 mill.

1612*d*. TIMORA ALBICILIA, Hmpsn. Cat. Lep. Phal. B. M., IV., p. 115, pl. 58, f. 18 (1903).

♂. Head and thorax dull brown, the latter tinged with pink; abdomen ochreous, dorsally tinged with fuscous. Forewing ochreous, the costal area, except costal edge, median nervule and nervules and vein, with diffused pink streaks; the inner margin suffused with fuscous; the terminal area suffused with pink; cilia pink at base, white at tips. Hindwing ochreous, suffused with fuscous; the cilia ochreous. Underside of forewing fuscous, the marginal areas ochreous.

Habitat.—SIKKIM. *Exp.* 26 mill.

1617*a*. TIMORA MODESTA, Moore, P. Z. S., 1881, p. 366. Hmpsn. Cat. Lep. Phal. B. M., IV., p. 116, pl. 58, f. 20.

Curubasa calamaria, Moore P. Z. S., 1881, p. 367.

Pale brownish ochreous; head and thorax brown in male; legs tinged with fuscous. Forewing sometimes with slight pink tinge on costal and inner areas; slightly paler fasciæ in discal and submedian folds. Hindwing paler.

Habitat.—PUNJAB, Manpuri; Jubbulpore, BOMBAY. *Exp.* 24—30 mill.

1617. TIMORA ARTAXOIDES.

1617*b*. TIMORA HOLOLEUCA, Hmpsn. Cat. Lep. Phal. B. M., IV., p. 117, pl. 58, f. 23 (1903).

♂. Head, thorax and abdomen white, slightly tinged with fuscous brown. wings silvery white, the costa of forewing slightly tinged with brown. Underside of forewing suffused with fuscous to near termen below costa only, or the median nervule, or inner margin.

Habitat.—ABYSSINIA ; MADRAS, Belgaum. *Exp.* 24 mill.

Genus ADISURA.

A. Forewing with the cilia wholly pink .... *dulcis.*
B. Forewing with the cilia white-tipped.
  a Forewing largely suffused with grey and irrorated with fuscous .... *atcinsoni.*
  b Forewing not suffused with grey and irrorated with fuscous.
    *a*¹. Forewing with the costal and inner areas more or less prominently suffused with pink, the cilia pink at base .... *marginalis.*
    *b*¹. Forewing with the costal and inner areas not tinged with pink, the cilia ochreous at base .. .. *straminea.*

1600*a*. ADISURA DULCIS, Moore, P. Z. S., 1881, p. 369. Hmpsn. Cat. Lep. Phal. B. M., IV., p. 119, pl. 58, f. 26.

Head and thorax dark red-brown ; pectus and legs ochreous mixed with rufous ; abdomen ochreous. Forewing golden-yellow ; the costal area white ; broad deep pink fasciæ on costal and inner areas ; the base of inner margin fuscous ; termen and cilia pink. Hindwing ochreous, the veins and terminal area suffused with fuscous. Underside of forewing fuscous, with ochreous streak just beyond and below end of cell ; the terminal area yellow, pink at costa.

Habitat.—SIKKIM ; ASSAM, Khasis ; QUEENSLAND. *Exp.* 32 mill.

1600. ADISURA ATCINSONI.

1606. ADISURA MARGINALIS, Wlk. XII. 830, (1857).

Heliothis delicia, Feld., Reis. Nov., pl. 108, f. 40

Adisura similis, Moore, P. Z. S., 1881, p. 369.

1600*b*. ADISURA STRAMINEA. Hmpsn., Ann S. Afr. Mus II., p. 258 (1902) ; id. Cat. Lep. Phal, B. M., IV., p. 121, pl. 58, f. 28.

Pale straw yellow ; sides of palpi and frons, the neck behind the eyes, and upperside of fore and mid legs red-brown. Forewing with the costal edge white ; somewhat paler streaks in and beyond cell and below the cell and vein 3 ; indistinct dark points in and beyond upper angle of cell and a postmedial series curved from costa to vein 4, then oblique to submedian fold. Hindwing whitish, suffused with strawcolour towards termen.

Habitat.—N. GAMILAND : BOMBAY, Deesa. *Exp.* 24 mill.

Genus ISOCHLORA.

Isochlora, Staud. Stett. Ent. Zeit., 1882, p. 39 .... *viridis.*

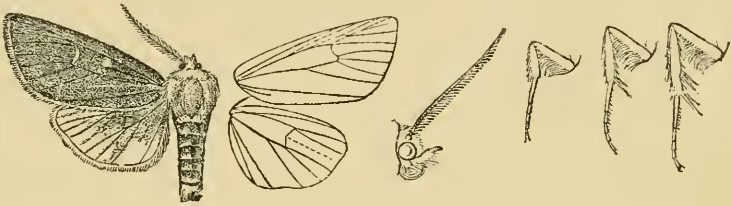
Proboscis fully developed ; palpi short, oblique, fringed with long hair in front ; frons smooth ; eyes large, rounded : antennæ of male bipectinated with moderate branches to apex ; head and thorax clothed with hair only : fore tibiæ fringed with hair; mid and hind tibiæ spined; abdomen dorsally clothed with rough hair towards base and laterally fringed with hair. Forewing with the apex somewhat produced; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle.

Sect. I. Antennæ of female bipectinate with short branches.

1948. ISOCHLORA CHLOROPTERA.

Sect. II. Antennæ of female serrate.

1947. ISOCHLORA VIRIDIS, Staud. Stett. Ent. Zeit., 1882, p. 39: Alph. Hor. Soc. Ent. Ross, XVII, p. 78, pl. 2, f. 5.



Isochlora viridis ♂ $\frac{1}{1}$.

Isochlora albivitta, Alph. Hor. Soc. Ent. Ross, XXVI, p. 448 (1892); id. Rom. Mem., IX., p. 42, pl. 1, f. 3.

Nonagria fuscovirens, Hmpsn., Moths. Ind., II., p. 285 (1894).

Habitat.—SIBERIA; E. TURKESTAN; TIBET; KASHMIR.

Genus OROSAGROTIS.

	Type.
Orosagrotis, Hmpsn. Cat. Lep. Phal. B. M., IV., p. 135 (1903)...	*montana.*

Proboscis fully developed; palpi obliquely upturned, the 2nd joint fringed with long hair in front, the 3rd moderate, porrect; frons with truncate conical prominence; eyes small, elliptical; antennæ of male minutely serrate and fasciculate; head and thorax clothed with rough hair; tibiæ spined. Forewing rather narrow; vein 3 and 5 from close to angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with vein 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 shortly stalked.

A. Forewing with the orbicular produced to a point confluent with the reniform	*amphora.*
B. Forewing with the orbicular not produced to a point	*cashmirensis.*

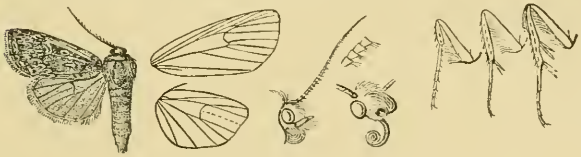
1619*d*. OROSAGROTIS AMPHORA, Hmpsn. Cat. Lep. Phal. B. M. IV, p. 135, pl. 59. f. 17 (1903).

♂. Head and thorax grey mixed with pale brown; tegulæ with medial black line; abdomen brownish grey. Forewing grey suffused with pale brown and slightly irrorated with fuscous; the sub-basal line represented by obscure black points below costa and cell; the antemedial line indistinct, blackish and slightly angled outwards in cell and very strongly above inner margin; claviform slightly defined by black; orbicular and reniform with brown centres and whitish annuli defined by brown, the former produced to a point confluent with the latter, the cell below it suffused with dark-brown; the postmedial line minutely dentate, bent outwards below costa and oblique below vein 4; the sub-terminal line whitish, dentate, defined on inner side by a series of small obscure dentate dark marks; a terminal series of black points; cilia whitish with a dark line through them. Hindwing pale, suffused with fuscous brown and with a darker terminal line; the underside whitish with small discoidal spot and curved postmedial line.

Habitat.—Kashmir, Digha Pass, 15,000′. *Exp.* 30 mill.

1619*e*. Orosagrotis cashmirensis, Hmpsn. Cat. Lep. Phal. B. M. IV, p. 136, pl. 59, f. 20 (1903).

♂. Head and thorax black brown mixed with some grey; abdomen fuscous brown. Forewing pale brown mostly suffused with black leaving a pale fascia below costa; an indistinct curved sub-basal line from costa to submedian fold; the antemedial line slightly defined by brown on inner side, slightly waved, oblique from costa to above inner margin, where it is strongly angled; claviform defined by black; orbicular and reniform with brown centres and pale brown annuli defined by black, the former small, round, the latter narrow; the postmedial line minutely dentate, angled outwards at vein 7, then very oblique, defined on outer side by pale brown, emitting streaks defining the dark veins to the subterminal line, which is pale, defined by dentate dark marks on inner side, angled outwards at vein 7 and excurved at middle; a fine terminal dark line and line at base of cilia. Hindwing pale fuscous brown; the cilia white with brown line at base; the underside whitish the costal and terminal areas suffused with brown, a slight discoidal point.



Orosagrotis cashmirensis ♂, $\frac{1}{1}$.

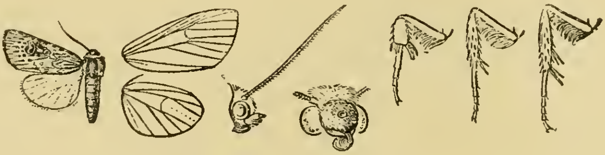
Habitat.—Kashmir, Kardong, 14,000′. *Exp.* 30 mill.

Genus Micragrotis. *Type.*

Micragrotis, Hmpsn. Cat. Lep. Phal. B. M. IV., p. 148 (1903) ... *axylides.*

Proboscis rather small; palpi short, oblique, fringed with hair below; frons with truncate corneous prominence with raised edges and curved corneous plate below it; antennæ of male minutely ciliated; head and thorax clothed with hair and scales; foretibiæ short and broad, spined at sides, with two long curved claws on inner side at extremity, and short claw or claws on outer; mid and hind tibiæ spined. Forewing short, the apex rounded; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 stalked.

1619f.—Micragrotis axylides, Hmpsn. Cat. Lep. Phal. B. M. IV., p. 150, 1903.



Micragrotis axylides ♂

Head and thorax ochreous mixed with fuscous ; patagia with a purplish tinge ; tarsi with black and pale rings ; abdomen ochreous tinged with fuscous brown. Forewing greyish ochreous suffused with purplish brown ; the veins streaked with blackish ; two fine pale streaks in base of cell ; the antemedial line double the inner line indistinct, dentate and angled strongly inwards on subcostal and median nervures and vein 1 ; orbicular and reniform small with blackish centres and pale annuli defined by black, the former round, the cell between them and area above it suffused with fuscous black ; traces of an oblique shade from lower angle of cell to inner margin ; the postmedial line indistinctly double, dentate and produced to black and white points on the veins, bent outwards below costa, incurved at discal fold and below vein 4 ; a terminal series of black points. Hindwing yellowish white, the costal area and termen slightly tinged with brown ; the underside with the costal area irrorated with brown.

Habitat.—Punjab, Mean Meer ; Sind, Bhug. *Exp.* ♂ 25, ♀ 30 mill.

Genus Euxoa.	*Type.*
Euxoa, Hübn., Verz., p. 209 (1827)	*decora.*
Rhyacia, Hübn., Verz., p. 209 (1827)	*lucipeta.*
Mimetis, Hübn., Verz., p. 210 (1827)	*decora.*
Metaxyia, Hübn , Verz., p. 223 (1827)	*ritta.*
Exarnis, Hübn., Verz., p. 225 (1827)	*obelisca.*
Scotia, Hübn., Verz., p. 226 (1827)	*cinerea.*
Brotis. Hübn., Verz., p. 226 (1827)	*nigricans.*
Agronoma, Hübn., Verz., p. 227 (1827)	*crassa.*
Georyx, Hübn., Verz., p. 227 (1827)	*segetis.*
Telmia, Hübn., Verz., p. 227 (1827)	*cursoria.*
Tetrapyrgia, Wlk., XXXIII, 711 (1865)	*porphyricollis.*
Elegarda, Wlk., XXXIII, 712 (1865)	*porphyricollis*
Pleonectopoda, Grote, Bull. Buff. Soc. Nat. Sci., 1. p. 136 (1873)	*lerisi.*
Orbifrons, Staud, Stett. Ent. Zeit. XXXVIII, p. 187 (1877)	*singularis.*
Carneades, Grote, Can. Ent. XV, p. 4 (1883), Nec. Bates Col. 1869	*mœrens.*
Paragrotis, Pratt., Can. Ent. XV. p. 4 (1883)	*mœrens.*
Chorizagrotis, Smith, Bull. U. S. Nat. Mus. XXXVIII, p. 98 (1890)	*auxiliaris.*

Rhizagrotis, Smith, Bull. U. S. Nat. Mus. XXXVIII, p. 103 (1890) .... *acclivis.*
Agrotis, Hübn., Tent ined .... *segetis.*

Proboscis fully developed; palpi upturned, the 2nd joint fringed with hair in front, the 3rd moderate; frons with truncate conical prominence with raised rim; vestiture hairy; tibiæ strongly spined; pro- and meta- thorax with rather spreading crests. Forewing with veins 3 and 5 from close to angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle.

Sect. I. (*Scotia*). Antennæ of male bipectinate with moderate branches the apical third serrate.

A. Hindwing white, the terminal area more or less tinged with brown, in female only........ *segetis.*
B. Hindwing more or less suffused with brown, especially in female .... *corticea.*

1620. Euxoa segetis, Schiff. Wien Verz., pp. 81. 252, f. 3. a. b. (1776) Hübn Eur. Schmett. Noct., f. 147.
Noctua præcox, Hübn. Eur. Schmett. Noct., f. 359 (1827) nec Linn.
„ *fervida*, Hübn. Eur. Schmett. Noct., f. 711 (1827).
Agrotis sicula, Boisd. Gen. and Ind. Meth., p. 109 (1840).
„ *dimidia*, Zell. Iris. 1847, p. 439.
„ *sicania*, Guen. Noct. 1, p. 275 (1852).
„ *marginalis*, Wlk. X. 339 (1856).
„ *obliviosa*, Wlk. X. 340 (1856).
„ *aversa*, Wlk. X. 345 (1856).
„ *correcta*, Wlk. X. 345 (1856).
„ *denticulosa*, Wllgrn. Wien. Ent. Mon. IV., p. 168 (1860).
„ *conspurcata*, Wlk. XXXII, 696 (1865); Moore, Lep. Ceyl. III, pl. 146, f. 7 a.
„ *repulsa*, Wlk. XXXII, 696 (1865).
„ *certificata*, Wlk. XXXII, 697 (1865).
„ *ingrata*, Butl. A. M. N. H. (5) 1, p. 162 (1878); id. Ill. Het. B. M. II., p. 27, pl. 29, f. 9.
„ *pallida*, Staud Stett. Ent. Zeit. 1881, p. 423.
„ *fucosa*, Butl. Trans. Ent. Soc., 1881, p. 179.
„ *lassa*, Swinh. P. Z. S. 1886, p. 444.

1621. Euxoa corticea, Schiff. Wien. Verz., 81, 15 (1776); Hübn. Samml. Eur. Schmett. Noct., f. 145.
Noctua sincera, Frr. Beitr. Eur. Schmett, 544. 2 (1827).
„ *obscura*, Frr. Beitr. Eur. Schmett, 628. 1. 2 (1827).
„ *transversa*, Wlk. X. 354 (1856).
Agrotis fraterna, Moore, Lep. Atk., p. 116 (1882).
„ *amurensis*, Staud, Rom. Mém. VI, p. 42 (1892).

Sect. II. (*Exarnis.*) Antennæ of male bipectinate with short fasciculate branches, the apical part serrate.

A. Hindwing white, the terminal area often tinged with brown.
  a Forewing with the veins of terminal area defined by pale dentate marks.
    a^1 Forewing with the claviform pointed at extremity *spinifera*
    b^1 Forewing with the claviform rounded at extremity .... *obelisca ab. fictilis.*
  b Forewing with the veins of terminal area not defined by pale dentate marks........................... *obelisca.*
B. Hindwing entirely suffused with brown............ . ... . . *tibetana.*

1622. EUXOA SPINIFERA, Hübn. Samml. Eur. Schmett. Noct. f. 389 (1827).
Telmia spinula, Hübn. Verz., p. 228 (1827).
Agrotis biconica, Koll. Hügel's Kashmir, iv., p. 480 (1848).
„ *exigua,* Koll. Hügel's Kashmir, iv., p. 481 (1848).
„ *spiculifera,* Guen. Noct. 1, p. 266 (1852).
„ *aristifera* Guen, Noct. 1, p. 266 (1852).
„ *ferina,* Feld. Reis. Nov. pl. 110. f. 12 (1874).
„ *hodnæ,* Oberth. Ét. Ent. iii., p. 45, pl. 5, f. 8. (1878).

1622*a*. EUXOA OBELISCA. Schiff. Wien. Verz. p. 80 (1776), Hübn. Samml. Eur. Schmett. Noct. f. 123.
Noctua puris, Hübn. Samml. Eur. Schmett. Noct. f. 416 (1827).
„ *praticola,* Hübn. Samml. Eur. Schmett. Noct. f. 567 (1827).
„ *fictilis,* Hübn. Samml. Eur. Schmett Noct. f. 710 (1827).
Agrotis villiersii, Guen. Ann. Soc. Ent. Fr. 1837, p. 173, pl. 8, ff. 1·2.
„ *declarans,* Wlk., x, 347 (1856).

Head and thorax fuscous mixed with grey ; tegulæ with blackish medial line ; tarsi banded with black ; abdomen grey-brown. Forewing purplish-brown, the inner and terminal areas paler ; the costal area suffused with white to the postmedial line ; a black streak below base of cell ; an indistinct sub-basal line, curved, from costal to submedian fold ; a double waved antemedial line from subcostal nervure to vein 1 ; claviform defined by black ; orbicular and reniform large, grey-white defined by black, their centres slightly defined by brown, the cell before and between them suffused by blackish, the orbicular oblique elliptical ; the postmedial line minutely dentate, indistinct, bent outwards below costa, excurved to vein 4, then incurved ; the subterminal line pale, defined by slight dentate dark marks on inner side ; the area beyond it darker except at apex, angled outwards at vein 7 and dentate at veins 4·3 ; a terminal series of black points. Hindwing white, the veins and termen tinged with brown, more strongly in female ; the underside with the costal and terminal areas irrorated with brown, a slight dark discoidal spot.

ab. 1 *fictilis.* Forewing with the veins of terminal area defined by pale dentate marks. Head, thorax and forewing usually much more ochreous.

ab. 2 *ruris.* Head and thorax much greyer-brown, forewing grey-brown irrorated with dark-brown and black; no black below base of cell or in cell; the antemedial line complete and more strongly angled outwards above inner margin; hindwing more tinged and irrorated with brown.

Habitat.—EUROPE; ALGERIA; ARMENIA; ASIA MINOR; W. SIBERIA; W. TURKISTAN; ? AMURLAND; KASHMIR; Kuijar; Nubra. *Exp.* 38-40 mill.

1627. EUXOA TIBETANA, Moore, A. M. N. H. (5) 1. p. 233 (1878); id. 2nd Yarkand Mission, p. 10, pl. 1, f. 16.

Agrotis modesta, Moore P. Z. S. 1881, p. 351.
„ *monticola*, Hmpsn. Moths Ind. ii., p. 183 (1894).

Habitat.—LAHOUL; LEH; KASHMIR, Rajaori, Goorais Valley, Barra Larcha. *Exp.* 38 mill.

Sect III. (*Euxoa.*) Antennæ of male strongly serrate and fasciculate.

A. Forewing with veins 3· 4· 6· 7 defined by pale streaks strongly indenting the subterminal line .... *subspinifera.*
B. Forewing with veins 3· 4· 6· 7 not defined by whitish streaks indenting the subterminal line.
  a Forewing with the cell not filled in with black.
    a^1 Forewing with more or less prominent pale streak on median nervure .... *cursoria.*
    b^1 Forewing without pale streak on median nervure.
      a^2 Forewing reddish or fuscous brown.
        a^3 Hindwing brown, pale towards base .... *nyctopis.*
        b^3 Hindwing uniformly suffused with brown ...... *brevirami.*
      b^2 Forewing grey brown .... *conspicua.*
  b. Forewing with the cell filled in with blackish .... *islandica.*

1622 *b.* EUXOA SUBSPINIFERA, Hmpsn. Cat. Lep. Phal. B. M. iv., p. 205, pl. 61, f. 19 (1903).

♂ Head and thorax ochreous mixed with white; abdomen ochreous, the ventral surface whitish irrorated with pale-brown. Forewing whitish suffused with yellow-brown above submedian fold, in end of cell, and above veins 2 to 6; the veins with slight dark streaks; the costa irrorated with fuscous, with double dark striæ representing the sub-basal, ante and postmedial lines, and some white points towards apex; claviform elongate and defined by black; orbicular and reniform defined by black, the former very elongate and confluent with the latter; the subterminal line represented by a series of small whitish lunules, angled outwards at vein 7 and excurved at middle; a terminal series of small black lunules; cilia ochreous with a slight dark line through them. Hindwing white, the veins and a fine terminal line ochreous

Habitat.—PUNJAB: Ferozpur. *Exp.* 32 mill.

1633. EUXOA CURSORIA, Hüfn. Berl. Mag. iii., p. 416 (1767); Hübn. Samml. Eur. Schmett. Noct. f. 540.

Noctua mixta, Fabr. Ent. Syst. iii., 2, p. 118 (1794).
„ *sagitta*, Hübn. Samml. Eur. Schmett. Noct. f. 596 (1827).

Agrotis obscura, Staud. Cat. Lep. ii., p. 86 (1871).
,, *cespitis,* Swinh. Trans. Ent. oc. 1885, p. 340, pl. 9, f. 5.
,, *sagittata,* Staud. Iris., ix., p. 249 (1896).
,, *currens,* Staud. Iris., ix., p. 249 (1896).
,, *vaga,* Staud. Iris , ix., p. 250 (1896).

Habitat.—EUROPE ; ASIA MINOR ; W. TURKISTAN ; E. TURKISTAN ; MONGOLIA ; TIBET ; AFGHANISTAN ; QUETTA. *Exp.* 34-38 mill.

1633. *a.* EUXOA NYCTOPIS. Hmpsn. Cat. Lep. Phal. B. M., iv, p. 250, pl. 63, f. 30 (1903).

Head and thorax reddish-brown irrorated with white ; pectus brown and grey ; tarsi banded with black ; abdomen grey-brown. Forewing reddish brown, the basal area irrorated with grey ; a double, waved sub-basal line from costa to submedian fold ; a double, waved, somewhat oblique antemedial line ; claviform slightly defined by black ; orbicular and reniform fuscous defined by black, the former round, the latter with whitish annulus ; traces of a waved medial line ; the postmedial line double, dentate and produced to points on the veins, bent outwards below costa, excurved to vein 4, then oblique ; a whitish subterminal line, angled outwards at vein 7 and dentate at veins 4 and 3, the area beyond is tinged with fuscous ; a terminal series of black points ; a fine whitish line at base of cilia. Hindwing whitish tinged with brown, especially on terminal area ; the veins brown ; the cilia white with a brown line at base ; the underside with the costal area irrorated with brown, a dark discoidal point, traces of a curved postmedial line and diffused dark subterminal band.

ab. 1. Thorax with the ground-colour black-brown ; forewing dark-brown with the double lines filled in with whitish.

Habitat.—KASHMIR, Dras, Kuijar. *Exp.* 40 mill.

1626. EUXOA BREVIRAMI.

1626. *a.* EUXOA CONSPICUA, Hübn. Samml. Eur. Schmett. Noct. ff. 718-9 (1827).

Agrotis agricola, Boisd. Ind. Meth. Add., p. 3 (1829).
,, *lycarum,* Herr. Schäff. Eur. Schmett. Noct. ii, p. 333, ff. 122—4 (1846).
,, *squalida,* Ev. Bull. Soc. Nat. Mosc. 1856, ii., p. 181.

Head and thorax brown mixed with grey and irrorated with black ; tegulæ with blackish medial line ; tarsi banded with black ; abdomen grey, dorsally suffused with fuscous brown. Forewing grey, suffused with reddish-brown and irrorated with fuscous ; a double waved sub-basal line from costa to submedian fold ; a double waved antemedial line ; claviform slightly outlined with black ; orbicular and reniform large, grey, defined by black, often with fuscous centres, the former oblique elliptical ; a diffused waved medial line ; the postmedial line double, dentate and produced to points on the veins, bent outwards below costa, excurved to vein 4, then oblique ; a pale subterminal line, angled outwards at vein 7 and dentate on veins 4·3, defined by a dentate fuscous brown band on its inner side, interrupted below costa, some brown beyond it; a terminal series of black points. Hindwing whitish tinged with brown, especially towards termen and inner margin; the veins brown; cilia white with a brown line near base; the underside white, the costal and terminal areas irrorated with brown, a dark discoidal point, a curved postmedial series of short streaks on the veins, a terminal series of points.

ab. 1. Forewing with the markings indistinct.

Habitat.—EUROPE; CANARIES; ARMENIA; ASIA MINOR; SYRIA; PERSIA; W. TURKESTAN; E. TURKESTAN; AMUR; KASHMIR: Kokser, Barra Larcha, Dras; PUNJAB, Rawal Pindi. *Exp.* 44-50 mill.

1626*b*. EUXOA ISLANDICA, Staud. Stett. Ent. Zeit, 1857, p. 232; Hmpsn Cat. Lep. Phal. B. M. iv, p. 299, pl. 66, f. 15.

Agrotis rossica, Staud. Stett. Ent. Zeit., 1881, p. 419; Alph. Rom. Mém. v, p. 138, pl. 7, f. 3

Agrotis karschi Græser, Berl. Ent. Zeit., 1889, p. 253.

„ *nigra*, Staud. Iris. ix, p. 251 (1896).

Head and thorax dark-brown mixed with grey-brown, the head and part of tegulæ in front of the black medial line often whitish; abdomen grey-brown, the anal tuft pale fulvous. Forewing grey-brown, often much suffused with fuscous-brown; an irregular blackish streak below basal part of cell; the sub-basal line double, obsolescent, interrupted, extending from costa to vein 1; the antemedial line double, angled inwards on median nervure, then oblique and excurved below cell and vein 1; the claviform well developed, or large, defined by black, the obicular and reniform grey-brown or whitish, the former round or somewhat elliptical, the latter moderate, the cell before and between the stigmata and the area just beyond the reniform blackish; the postmedial line bent outwards below costa, incurved in discal fold, excurved beyond lower angle of cell, then oblique; the subterminal line indistinct, angled slightly outward at vein 7 and excurved at middle, with a series of dentate marks on its inner side; a terminal series of black points. Hindwing white tinged with brown, the veins, a slight discoidal mark, the costal and terminal areas brown; the underside with the costal area strongly irrorated with brown and with a distinct discoidal point.

Habitat.—ICELAND; RUSSIA; MONGOLIA; SIBERIA; KASHMIR, Kuijar, Nubra. *Exp.* 35—38 mill.

Section IV. (*Chorisagrotis*)—Antennæ of male minutely serrate and fasciculate.

A. Forewing dark fuscous brown .... *intracta.*

B. Forewing ochreous tinged with rufous ... . *xanthiodes.*

1628. EUXOA INTRACTA, Wlk. x. 346 (1856); Hmpsn. Cat. Lep. Phal. B. M. iv, p. 315, pl. 67, f. 6.

Spælotis ambigua, Butl. Ill. Het. B. M., vii, p. 54, pl. 128, ff. 10-11 (1889).

Habitat.—JAPAN; W. CHINA; KASHMIR; PUNJAB; NEPAL; TIBET, Yatung; SIKHIM.

1628*a*. EUXOA XANTHIODES, Hmpsn. Cat. Lep. Phal. B. M., iv, p. 315, pl. 67 f. 7 (1903).

♂. Head and thorax pale rufous; palpi and fore coxæ redder; fore tibiæ and tarsi whitish in front; abdomen reddish ochreous. Forewing ochreous suffused with rufous; an indistinct antemedial line angled inwards in cell and on vein 1, and outwards in submedian fold and above inner margin; orbicular and reniform small, pale, indistinct, the former round, an obscure medial shade passing between them; the postmedial line indistinct, minutely dentate, bent outwards below costa, excurved to vein 4, then incurved; an indistinct minutely waved subterminal line, slightly angled outwards at vein 7 and excurved at middle. Hindwing ochreous yellow, slightly tinged with fuscous brown except on termen and cilia. Underside of forewing tinged with fuscous to postmedial line except on costal area; hindwing yellow, the costal area tinged with rufous, an indistinct curved postmedial line.

♀. More olive-yellow and less rufous in tone; forewing with the markings more distinct.

Habitat.—KASHMIR, Barra Larcha, Goorais Valley. *Exp.* 38-40 mill.

Section V. (*Rhiacia*) Antennæ of male ciliated.

A. Forewing pale red-brown irrorated with black, the stigmata well defined.................. ...... *cirghisa.*
B. Forewing grey, the stigmata almost obsolete ...... *peperida.*
C. Forewing fuscous brown.................. .... *nyctina.*

1628*b*. EUXOA CIRGHISA.

Agrotis vallesiaca, Frr. Beitr. Eur. Schmett., p. 109, pl. 351, ff. 3-4 (1842). nec Boisd.
„ *Kirghisa*, Ev. Bull. Mosc. 1856, II, p. 219, pl. 1, f. 7. a. b.
„ *Squalorum*, Ev. Bull. Mosc. 1856, II, p. 22, Studf. Iris 1, p. 218, pl. 10, f. 9.
„ *Squalidior*, Staud. Cat. Lep. pal, p. 146 (1902).

Head and thorax very pale red-brown mixed with black: tegulæ with medial blackish line; tarsi banded with black; abdomen whitish tinged with red-brown. Forewing pale red-brown strongly irrorated with black; a waved sub-basal line from costa to submedian fold, a black spot on costa between it and the antemedial line which arises from a costal spot, is angled inwards in cell and on vein 1 and outwards in submedian fold and above inner margin; claviform with its extremity slightly defined by black; orbicular and reniform defined by black, the former somewhat elliptical, a waved medial shade passing between them; the postmedial line dentate, bent outwards below costa, slightly angled inwards in discal fold and incurved below vein 4; subterminal line indistinct, pale, minutely dentate, angled outwards at vein 7 and excurved at middle, defined on inner side by a series of dentate black marks and with blackish suffusion beyond it; a terminal series of black points. Hindwing white, the veins and terminal area tinged with brown; in female wholly suffused with brown. Underside white, the terminal area of forewing suffused with fuscous, of hindwing towards costa only.

ab. 1 *squalidior*. Rather paler; forewing brownish grey, the markings more distinct; hindwing with the terminal area brownish in male.

ab. 2 *squalorum*. Hindwing of male with the veins only tinged with brown, and in female the terminal area.

Habitat.—S. E. RUSSIA; ARMENIA; SYRIA; PERSIA; W. TURKISTAN; W. SIBERIA; E. TURKISTAN; KASHMIR, Dras: *Exp.* 36—40 mill.

1628*c*. EUXOA PEPERIDA, Hmpsn. Cat. Lep. Phal. B.M. iv, p. 329, pl. 67, f. 20 (1903).

Head and thorax grey-white pencilled with brown; palpi blackish at sides except at tips; tegulæ with medial black line; abdomen brownish-grey. Forewing grey-white irrorated with black; a rufous shade in, beyond, and below end of cell; the subbasal line represented by points on costa and median nervure; the antemedial line indistinct, waved, with more prominent points on costa, median nervure and vein 1; hardly a trace of orbicular or reniform; a slight fuscous shade at lower angle of cell; the postmedial line indistinct, dentate, with more prominent points on the veins, bent outwards below costa excurved to vein 4, then incurved; subterminal line hardly defined by a very slight shade on inner side; a terminal series of indistinct dark points. Hindwing white, the veins, inner and terminal areas suffused with brown; the underside white, the costal area irrorated with brown, a postmedial series of minute points on the veins.

Habitat.—KASHMIR, Goorais Valley. *Exp.* 42 mill.

1628*d*. EUXOA NYCTINA, Hmpsn. Cat. Lep. Phal. B.M., iv, p. 336, pl. 67, f. 29 (1903).

♂ Fuscous brown; head and thorax slightly mixed with grey. Forewing narrow, the margins subparallel, the apex rounded; slightly irrorated with fuscous; the sub-basal line represented by a few black scales below costa and cell; traces of an antemedial line oblique from costa to submedian fold where it is angled; orbicular and reniform defined by blackish, the former rounded, open above; the postmedial line very indistinct, bent outwards below costa, excurved to vein 4, then incurved; the subterminal line only defined by diffused blackish suffusion on inner side, curved; a fine pale line at base of cilia. Hindwing pale fuscous brown; the underside whitish, the costal and terminal areas irrorated with brown, a diffused, curved postmedial line.

Habitat.—KUMAON, Ralam Valley, 12,000′. *Exp.* 36 mill.

(*To be continued.*)

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THE ECONOMIC USES OF SHELLS.

By E. Comber, F.Z.S.

(*Read before the Bombay Natural History Society on the 9th February* 1905.)

I sometimes think that, while our Society is truly a field-naturalist's club, the majority of the papers that are printed in our journal are rather too scientific for the great bulk of our members, and although it is essential that we should foster this scientific research in every way we can, we should at the same time endeavour to encourage and interest the less scientific members of the Society by trying to show them that there is a great field for work which anyone can help in if he will take the trouble. Such work can well take the form of the collection of information with regard to the economic products of the country, and for this the scientific details can easily be supplied by the reference of specimens for identification to the Society's officials.

As I proceeded with the preparation of this paper I realised more and more the extent of the field that the subject covers and the impossibility of following up and investigating many details, but I hope it will encourage those who have the opportunities to contribute information where they can.

I would also ask you to consider whether the most is made in this country of the many valuable shell-fish that abound round our coasts and their products.

Shell-fish have been put to many uses by men from the earliest times. Their shells have been employed as money in many parts of the world by uncivilised peoples ; they have been, and always will be, used as ornaments ; the shell-fish themselves have formed an item of food from time immemorial ; and their shells again have been utilised for the purpose of producing such valuable commodities as lime.

I propose to deal with these various uses under their respective heads.

The employment of *shells as money* is a subject that need not be dealt with very fully as it is one that is bound to decrease with the advance of civilisation. Cowries have generally been the favourite shells selected for this purpose, owing no doubt to the beautiful polish that they possess. The so-called " Money Cowrie" (*Cypræa moneta*) is the customary variety and the value of them in India is somewhere about 96 to one pice (¼ anna). Dr. Watt's Dictionary of Economic Products (1899), to which I shall have to constantly refer, describes them as " imported into Bombay chiefly from the Laccadive and Maldive Islands, and from Zanzibar. " I elsewhere find it noted that " Cowries are imported to England from India and other places for the purpose of exportation to West Africa, to be exchanged for native products. " In a " Provisional List of Notes and References to the Chief Indian Animal Products " published by Dr. Watt in 1902 he writes : " With regard to the use of shells as coins, it is desired to obtain any valuable information as to the extent of this traffic." The imports of cowries into Bombay during the official year 1903-04 comprised 2,771 cwts. from British East Africa and 4,161 cwts. from Portuguese East Africa, say nearly 350 tons, which were valued at over Rs. 22,000. As to the imports from such dependencies as the Laccadive and Maldive Islands I have been unable to ascertain any figures. Unfortunately the exports of cowries are not distinguished separately from other shells so that no conclusions as to the extent of the trade can be drawn.

Turning to the question of the many ways in which *shells* are used *for ornaments* it is somewhat difficult to know where to commence, for the subject could easily be enlarged upon so as to fill a fair sized book.

The two main branches of the subject are undoubtedly pearls and mother-o'-pearl, though there is besides in India at any rate the extensive Chank or Conch shell fishery.

Taking *Pearls* first, it may be noted that from the most ancient times to the present day India has been looked upon as the chief market of the world for the best specimens ; but it must be admitted that this reputation is not altogether deserved as it is really from Ceylon and from the Persian Gulf that the majority, and certainly the best, of them come, though they largely find their way to other countries through the Bombay market.

Pearls are of course produced by quite a large number of bivalve shells, but the really valuable ones are found in the so-called " Pearl-oysters " of various species belonging to the genus *Margaritifera*, which is a section of the genus *Pteria* (=*Avicula*). Great confusion has existed as to the various species of this genus, but I suppose we may take a paper by Mr. H. L. Jameson published in the Zoological Society's Proceedings (1901) in order, as he describes, "to prevent further confusion of the common commercial form by zoological and economic writers," as the most recent authoritative opinion on the subject. From this paper it is evident that there is great variation in any one so-called species and that the sub-division into species is more or less arbitrary.

Quoting Rev. A. H. Cooke in the Cambridge Natural History, " Pearls are the result of a disease in the animal . . . . When the *Avicula* is large, well formed, and with ample space for individual development, pearls scarcely occur at all but when the shells are crowded together, and become humped and distorted, as well as affording cover for all kinds of marine worms and parasitic creatures, then pearls are sure to be found." It was formerly supposed that pearls were formed around some foreign matter, such as a grain of sand, that had become imbedded in the mantle of the animal and so been a source of irritation, but the usual cause is now generally recognised to be either a minute parasite or an ovum, or group of ova, that has escaped from an overgrown ovary and become imbedded in the mantle. Although originating in the mantle they frequently work their way out and lie loose between it and the shell, or become attached by subsequent nacreous deposit to the mother-o'-pearl surface of the latter. The hollow warty pearl, known as " blister pearl," is supposed to be produced by a deposit of nacreous matter at the point of invasion of a boring parasite. Now although the various species of " Pearl-oysters " all produce pearls of sorts, the larger species, such as *M. margaritifera* (Lin.), are fished chiefly for their marketable value for the " Mother-o'-pearl," and these are distinguished from the smaller species, such as *M. vulgaris* (Sch.) and its many varieties, by the entire absence of any trace of hinge teeth, which the latter possesses in a minute form.

By far the most important pearl fisheries round the coasts of India are in the Gulf of Manar, between Ceylon and Tuticorin, and they have been worked for over 2,000 years. A most interesting and authentic description of these fisheries appeared in the official publication of the Colombo Museum (known as *Spolia zeylanica*) in 1903 by the then Lieutenant-Governor, the Hon. E. im Thurn, who visited the fishery camp in the spring of that year when the Ceylon Government decided to allow the fishing to take place after an interval of 11 years. He even went so far as to personally inspect the oyster beds in a diving dress, his experiences of which he fully describes. So many accounts of the actual gathering of the shells by the divers have been published that I need hardly go over the ground again. On the return of the fishing fleet after the day's fishing the crews rush the baskets of oysters inside the Government enclosure and there each " take " is divided into 3 heaps, of which Government appropriate two, while the third is handed over to the fishermen as their share.

By about 9 p.m. the officials have pretty accurately ascertained the day's total, the Government share of which is then put up to auction at the temporary court-house to the number perhaps of millions for the one day's " take.'' Prices vary curiously and inexplicably in a single night, perhaps as much as Rs. 35 per thousand being given early in the evening, while later on no more than Rs. 22 may be bid, and yet again later still higher prices may prevail.

The washing of the pearls from the oysters is a most tedious, primitive and disgusting process, as they are simply left to rot for a week and then the larger pearls are sorted by hand from the seething, stinking mass. The residue is then dried in the sun and subsequently winnowed and examined until the smallest pearls have been picked out. The fishing goes on daily for some two months, when Government proclaim it closed, and the whole camp breaks up, leaving the jackals and other scavengers to take their share of the leavings among the great mounds of fresh shells that have been added to the accumulations of so many previous years, for these shells have not sufficient marketable value for their mother-o'-pearl to be worth shipping to the European markets. The Ceylon Government are now going fully into the question of how this primitive, insanitary system of sorting out the pearls can be improved.

From a recent notice about the Ceylon pearl fishery, that appeared in the New York weekly paper " Forest and Stream," I extract the following further particulars :—

" A remarkable feature about them has always been their uncertainty and intermittent character. For 50 years during the nineteenth century the banks produced nothing, and from 1837—54, and again from 1864-73, no pearls were collected.

"In view of the immense importance and value of these fisheries, an effort was recently made by the Colonial officers of the British Government to investigate the causes of these barren years, and also to find a remedy for them; and Prof. W. A. Herdman was asked to examine the records on this subject and to report on them. Following this report came a request by the Government that he should make a personal investigation of the pearl banks, and with Mr. Hornell, an assistant, he went to Ceylon and set about the work.

"The first step in the investigation was to make a complete survey of the whole sea bottom of the area of the pearl fisheries. This was done partly by sounding and dredging, and partly by the aid of divers, Mr. Hornell himself doing some investigation in a diving suit. Thus was gained much information as to the nature of the ground best suited to the growth of the pearl-oyster and the dangers to which the animal is exposed. It has many active enemies, such as sponges and mollucs and star-fishes, which bore through the shell, fishes and internal parasites. Yet, on the whole, the destruction caused by these agents is slight, compared with that caused by shifting sands, which overwhelm whole beds of oysters, burying and killing them. A bed of oysters, examined in March, which extended over an area of sixteen square miles, was covered by a vast multitude of young oysters 'so closely packed that the bank must have held not less than one hundred thousand million.' In November of the same year the spot was revisited and the oysters had disappeared, having been buried in the sand or swept down a steep slope outside the bed.

"Overcrowding is another fruitful cause of destruction which Professor Herdman suggests may be avoided by transplanting. That the star-fishes cause much damage is shown by an example given of a crop of oysters estimated in March 1902, as 5¾ millions, which had nearly disappeared by March 1903, from this cause."

The other great pearl producing fisheries of the world are in the Persian Gulf, of which the Island of Bahrein is the centre, and on the N. and N.-W. Coasts of Australia, the pearls being found in varieties of the same species of shell as in Ceylon waters. The Persian Gulf shells are known to the trade as "Lingah" shells from the principal port from which they are shipped, as these shells are sent to market for their mother-of-pearl value. The general method of procedure in the fishing is the same as in Ceylon.

On the west coast of India there are pearl fisheries at various places, but the gems are of comparatively small value. The most important of these is off the State of Nawanagar on the south side of the Gulf of Cutch, where the true pearl oyster is found, although it is rare on the coast generally. In confirmation of its scarcity, Mr. E. H. Aitken writes me that it "is not supposed to be found between the Persian Gulf and Ceylon, but I have a perfect specimen (very young) from the Ratnagiri coast and two halves from Kanara."

Having heard of the Nawanagar fisheries, and finding references to them in the "Bombay Gazeteer" of 1884, (Kathiawar, VIII, pp. 93 and 561), I tried to learn something more about them. Mr. Chester Kincaid has been good enough to send me several specimens of the shells, which prove to be undoubted true pearl-oysters, and through the courtesy of the Jamnagar Diwan has supplied me with the following notes about the fishery under date of 8th February 1905 :—

" (1) The yearly value of the Jamnagar Pearls fisheries is about Rs. 4,000.

(2) Pearl oysters are found along a coast line of 80 miles from Mangra near Jodya Bunder to Pindera in the Gulf of Cutch, and also in the islands of Ajad, Chauk, Kalumbar and Nora, which are also situated in the Cutch Gulf.

(3) The oysters are not procured by diving, but are fished off rocks when the tide is out. During the monsoon, for some reason unexplained, the collection of oysters is limited to 8 days in the month—*i.e.*, 12th to 15th of each half according to the Hindu Calendar.

(4) The fishermen are by law limited to the *Waghers* of ten villages, which are Varinar, Sashana, Sika, Balachedi, Jhakhar, Sarmat, Bharana, Salaya, Chudesar and Bedi.

(5) The collection is left entirely in the hands of the said Waghers, who at Divali (the Hindu new year) bring all the pearls gathered by them to the Durbar. Then an estimate is made and a fourth of their value is paid to the Waghers and the pearls handed over to the state treasury. This is the old time-honoured custom to which it is intended to revert. The British administration however broke through it and farmed out the pearl fisheries.

(6) The present year the oysters have been given a close season."

So far as I have been able to learn this is the only part of the West Coast of India where the true pearl-oyster is gathered. The pearls in other localities are procured from a very different kind of shell, *viz.*, the so called "Window-oyster" belonging to the genus *Placuna*. The shells are flat, thin and transparent, being still used in Goa and its neighbourhood as a substitute for glass in windows. They are very abundant from Karachi to the Kanara district and wherever they occur in any abundance they are collected for the sake of the small pearls found in them. Of this fishery in Karachi, Mr. E. H. Aitken writes me that it "is farmed out by Government for a good sum. In 1900, the amount realised was Rs. 3,650 for a period of 3 years, but the farmer lost heavily and in 1904 the highest offer for a similar period of 3 years was Rs. 1,851. Pearls may be found in as many as 10 to 20 per cent. of mature shells. They are small and imperfect and not worth much as jewels, but they are also used in native medicines and are burned to make the black powder with which native ladies beautify the eyelids of their children. No use is made of these oysters, or their shells, after the pearls are removed though I believe they are considered eatable by the poor.

It may surprise some of you to hear that there formerly existed a pearl fishery in Bombay harbour, and regarding it I cannot do better, I think, than quote the following reference to it from the Bombay Gazetteer, (Thana), published in 1882. "Pearls are found in the Thana creek from Belapur to Thana. Their existence (does not) appear to have been known to the people in the district till lately . . . The shells, *shimplas*, are flat and round. The pearls, which are of a pale, whitish colour, vary in size from a poppy seed to a grain of millet. They are sometimes found the size of a pea. Except some that are sold in the district and are used by the natives in medicine, they are bought by pearl merchants and sent to China. Pearls are sold by the tola, which cost about 14*s.* (Rs. 7) to collect, and sells at from Rs. 8 to 11. For the last two years the right of fishing has been sold by Government; it realised Rs. 102 in 1878 and Rs. 214 in 1879."

In 1901-02 there was much excitement about the pearls found at Belapur and it was said that quantities were being collected.

Of other shells that produce pearls may be mentioned the fresh water mussels of India (*Unio marginalis* and *U. flavidens*), which Dr. J. Anderson describes as collected near Berhampur in Bengal, and similarly the seed pearls obtained from the nearly allied fresh water mussel of the British Isles (*Unio margaritiferus*) have also a small commercial value. These small pearls, including most of those from the "Window oyster," besides being used to some extent for ornamental purposes, are supposed to possess invigorating powers and are used chiefly as a medicine. Quoting Dr. Watt, they "have been used in medicine from a very ancient period. . . . They are purified for use by being boiled with the juice of certain leaves and flowers." "They are then calcined in covered crucibles and reduced to powder. The powder thus formed is believed to be similar in properties to coral, and is generally used in combination with that substance. It is esteemed in urinary diseases, consumption, &c., and is said to increase the strength of weak patients. . . . The only virtue possessed by the gem is doubtless that of an antacid, a property for which it was used at one time in European medicine, and even held a position in the British Pharmacopæa."

When we turn to the second great commercial purpose to which the pearl-oyster is put, the field before us is an extensive one, as is exemplified by the array of exhibits on the table representing some of the economic *uses of mother-o'-pearl.*

This term is generally employed to describe the nacreous lining of many shells, but is more properly applied to the shells of several species of *Margaritifera,* which is of far greater commercial value on account of its lustre and thickness, which allows of its being manufactured into such useful articles as buttons, knife handles, spoons, plates, &c., besides the purely ornamental articles of which there are a fairly representative selection before you.

I believe, the very pick of the shells that come on the London market are selected and fetch a special price for export to New York for the purpose of supplying the mother-o'-pearl side-plates for the handles of revolvers, which are greatly appreciated by Mexican and other 'cow-boys'- in fact no cow-boy can attain any standing in his profession unless possessed of one of these mother-o'-pearl handled 'guns.'

The shells of *M. margaritifera* provide the greatest supply of mother-o'-pearl to the European markets, being now obtained most largely from the fisheries of the N. and N.-W. Coasts of Australia, besides the Persian Gulf, Straits Settlements and the Islands of the Pacific. The nacre is highly irridescent, often somewhat steely in lustre and generally with a marginal band of dark metallic green, bronze or brassy yellow, while some varieties are quite smoky. They are known in the trade as 'Banda' shells with a prefix indicating the port from which the supply is shipped to the London market, *e. g.*, the Australian shell or Zanzibar shell, with other distinguishing descriptive titles as the Black-lipped Banda, &c. The 'Lingah' or 'Bombay shell' of the trade is the smaller pearl-producing species from the Persian Gulf and is of comparatively little value for its mother-o'-pearl owing to the large supply and limited demand.

The yearly import of mother-o'-pearl shells into England exceeded in value a quarter of a million sterling some years ago, and may possibly now be larger still, though a large proportion of this is re-exported to Continental Europe. As regards local trade in Bombay I can supply the following figures for the official year 1903-4, when the imports amounted to some 90 odd tons of a value of nearly half a lakh of rupees, or about Rs. 33 per cwt. They were imported chiefly from Arabian and Persian Gulf ports, and to some extent from East Africa and Aden. Of exports from Bombay, which, as already mentioned, do not distinguish other shells from cowries, &c., the value for the year 1903-04 amounted to Rs. 1,19,000, going almost entirely to the United Kingdom and Trieste.

The process of manufacture of mother-o'-pearl buttons is thus described in Chamber's Encyclopædia (1888). " Small cylinders are cut out of the shells with a tubular saw. These are then split into discs, which are shaped by a steel tool, drilled with holes and finally polished with rotton-stone and soft soap, or by a more recent method with ground charcoal and turpentine."

With the facilities that cheap labour provide, is there not surely a great field for the development of the industry of manufacturing mother-o'-pearl articles in this country, situated as it is so conveniently to the sources of supply ? At present, it appears never to have been developed to any extent, and, so far as I am aware, not a single one of the mother-o'-pearl articles that we exhibit to-night was manufactured in India.

The next important use of shells to which I shall refer is the *Chank or Conch* fishery of Southern India. These shells are obtained chiefly in the Gulf of Manar and also at Travancore and Tuticorin. An important paper was published in 1894 by Mr. Thurston dealing with the details of the fisheries and industry. Besides being employed extensively as horns blown at temples, they are manufactured into a number of ornamental articles, such as bracelets, rings, buttons, &c., and this industry is chiefly carried on at Dacca and also at Dinajpur and Sylhet. Dr. Watt appeals for " more direct commercial particulars and more recent facts, such as extent of trade, regions of supply, markets to which exported, season procurable, prices, &c."

In this connection I may perhaps here mention the same author's reference to " the aquamarine shell carved work of Jaipur," but I am not acquainted with this work and have not been able to obtain a specimen. Information regarding it, the species of shell employed, and whence obtained, would be interesting.

Another ornamental use to which shells are put is the carving of *Cameos*, which it is hardly necessary to describe as engraved gems in which the subject is cut in relief. For the best cameos stratified stones, such as onyx and agate, are used, but owing to the difficulty of obtaining suitable material shell cameos were introduced in Italy about the fifteenth century. The most useful shells are of course those with several layers of different colours, and I find the "Bull's mouth" with the under layer red, the "Black helmet" with a dark onyx ground, and the "Queen's conch" with a pinkish ground described as the most valuable for the purpose, but I have not been able to ascertain the genera to which these shells belong.

Before leaving the subject of the uses of shells for ornamental purposes I must here mention the Giant Clam (*Tridacna gigas*), which have been known to weigh as much as 500 lbs. the pair, as used for containing holy water in French churches—notably a pair at St. Sulpice in Paris. I must also draw attention to the many highly artistic and ornamental articles made from shells that have been loaned to us for the occasion by Bhicaji & Co.—most of which, I am informed, are manufactured in Siam—and the panels of Japanese work inlaid with carved shell lent by Hinode & Co.

Our next consideration must be the uses to which shell-fish are put *as an article of food*. This is a subject that might well be made into a paper by itself, as the use of them is universal all over the marine littoral of the world.

First and foremost of course from a European point of view come the edible *oysters*, which are regarded as a delicacy wherever Europeans are found.

According to Messrs. Melville and Abercrombie's paper that appeared in our Journal, Vol. VIII, p. 345, the edible oysters of this coast are stated to be probably confined to two species, *viz.*, *Ostræa plicata* (or *crenulifera*) and *O. bicolor*, but it is admitted that the discrimination of the species is very difficult.

Regarding the use of them by natives on this coast Mr. Aitken writes that "from Bombay southwards the oyster is eaten by the Hindu fishermen and lower castes. In Sind, where the poorer population is Mahomedan, the oyster is not eaten, nor any other molluscs I believe. Karachi was once famous for its oysters, but now the demand is mostly supplied from Kathiawar and Cutch. During the last few years efforts have been made to protect them by closing certain sections of the coast for a time and forbidding the removal of shells under a certain size."

While on the subject of edible oysters some reference is necessary to the artificial cultivation of them. As many as 2,000 years ago this appears to have been undertaken on a large scale by the Romans, who appreciated oysters as much as we do at the present day, and oyster farms have been more or less paying concerns ever since. The most extensive on the British coasts are those at Whitstable on the Thames estuary, where they extend over an area of more than 27 square miles; but, large as these and other British oyster farms may be, we are far surpassed in this industry by both the French and the Americans, who have applied even more scientific methods of economic cultivation resulting in a far larger output. While it has been estimated that the annual production in Great Britain is not less than sixteen hundred millions, that in France is much larger, and in America the estimate has been put at over five thousand millions. The artificial cultivation of oysters has engaged a good deal of attention too in Australia, but while it is an industry that might possibly develop to some extent on the coasts of India, there is little likelihood of its growing into anything like the business it is in other countries owing to the climatic difficulties of transport to large consuming markets, as oysters do not readily lend themselves to preservation by the process of drying or otherwise.

On the British coasts mussels and cockles are largely collected for food and form a welcome variety to the bill of fare of the poorer classes. Wherever mussels can be dredged in large quantities they are shipped by the truck-load to the large inland manufacturing towns.

Our local representative of the mussel (*Mytilus smaragdinus*) on this coast is considered one of the best of all shell-fish, and our large local cockle (*Cardium coronatum*) is also eaten, while the shells of the latter are sold in retail shops to be burnt into a special lime for eating with *pan supari*.

Besides the above species Mr. Aitken has kindly furnished me with the following information about other shell-fish that are eaten on this coast:—

" *Meretrix morphina*, *Meroë solandri*, *Chione pinguis* and *radiata*, especially the last two, constitute a large proportion of the food of the coast population. At low spring tides the women turn out in hundreds and wade into the creeks to grub them out of the mud.

" *Tapes malabarica* is eaten even by the Mahomedans on the Ratnagiri coast, who are not so particular as those of Sind, and allow some kinds of shell fish as have not what they describe as ' black blood.'

" *Donax incarnatus* is considered a delicacy and much eaten. It is exceedingly common on smooth beaches between watermarks. As the tide recedes each wave leaves a number uncovered, and although they bury themselves very nimbly, men on the watch rush in and pick them out.

" *Asaphis diphos* and other species of this family (*Psammobüdæ*), as well as *Anatina labiata* are eaten."

Of univalves (*Gasteropoda*) not many are used for edible purposes, but a few—*e.g.*, *Turbo intercostalis* (= *elegans*), *Purpura bufo* and *P. carinifera* are eaten. The latter is called *bhikari* (beggar) and not much esteemed.

Fresh-water molluscs, owing to their insipidity, do not form a desirable article of diet, but land snails have been looked upon as a delicacy in parts of Europe ever since Roman days, though they are not generally eaten in the British Isles, or, so far as I am aware, in India. Of their excellence, however, I can personally vouch from my own experience. The large edible snail of Europe (*Helix pomatia*) was introduced into England by the Romans at the time they held the country and about the sites of old Roman habitations this particular species is still found. At the same time snails are eaten in England, and only lately I met an old man in Somersetshire collecting them (*Helix aspersa*) with an iron hook on the end of a stick from the crevices in old walls, who informed me that he made his living by it as they were in great demand among the glass-blowers of Bristol, who looked upon them as a great specific for the cure of the lung diseases that many of them suffer from. In this connection Rev. A. H. Cooke gives various instances in different parts of the British Isles of the firm belief still existing among the lower classes in the curative powers of young slugs in consumptive cases when eaten—sometimes alive!

Of other molluscs that are extensively eaten in certain parts of the world, I must mention the cuttlefish family (*Cephalopoda*). Regarding them as food Dr. Cooke writes: "Dried Cephalopods are a favourite Chinese dish, and are regularly exported to San Francisco, where the Chinese make them into soup." In this connection, too, I quote Dr. Watt, who wrote (1902): "Although there is every reason to believe that a large trade might be organised in Indian cuttlefish, the industry would appear to be entirely neglected." He then goes on to refer to an account of the Chinese fisheries that appeared in the Journal of the Society of Chemical Industries (Vol. VIII, p. 580). To what extent they are eaten on the West Coast of India, I have failed to obtain information, but one sees them occasionally in the Bombay Market.

On this coast, shells are very extensively burned *for making lime* for building and other purposes. This is undoubtedly a really important industry, but I have been unable to obtain any details that go further than the references to it in the Bombay Gazetteer, so must content myself to the following extracts therefrom:—

"At Kurla a considerable quantity of shell lime is made by burning cockle shells found in the neighbouring creeks. This lime is what is termed 'fat,' and is not suitable for building work. It is chiefly used for white-washing."*

"The lime in general use is made from calcined cockle shells. There is an inexhaustible quarry of these shells in the bed of the Ratnagiri creek near the village of Juva, about two miles from Ratnagiri. This quarry supplies the whole district with lime, which in Ratnagiri costs Rs. 12 to 15 the hundred cubic feet. Shell lime possesses little cementing properties and only answers when used with laterite stone." †

On the Bengal coast the shells of *Telescopium fuscum* and *Pyrazus palustris*, both estuarine species, are burnt for lime, but these do not occur in sufficient quantities on this side for the purpose. Inland, certain fresh-water shells are utilised for a similar purpose to some extent.

In conclusion, I shall now only refer to two peculiar, but interesting, uses to which cowries are put. A large cowrie has for long been recognised as the best of all known things to put into the toe of a sock or stocking when it becomes necessary to darn them, and is commonly used for this purpose.

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* *Bombay Gazetteer*, Thana, XIII, pt. 1, p. 21 (1882).

† *Bombay Gazetteer*, Ratnagiri, Vol. X, p. 31.

The other is an almost purely local use of the cowrie. A large specimen of *Cypræa tigris* is employed for polishing the cloth that is used for covering Parsi hats. The cloth is imported from China and the highly glazed surface is obtained by rubbing the face of it with a cowrie shell to which a little cocoanut oil has been previously applied.

Finally, may I be allowed to appeal to any of our members, who may be in a position to do so, to contribute any further notes on the uses to which shells and shell-fish are put in this country, or further details of those to which I have alluded.

FURTHER NOTES ON THE FLORA OF NORTHERN GANJAM.

By Cecil E. C. Fischer, I.F.S.

(Continued from page 556 of *Vol. XV.)*

The first note was compiled when expecting to leave the Ganjam District for good early in 1904. As my stay continued till the first week of 1905, I was enabled to make further notes, and the following supplemental list is the result.

The list is, of course, even now incomplete, especially with regard to the *Cyperaceæ and Gramineæ.*

The most striking features in the flora are the large preponderance of *Leguminoseæ* (137 species), the comparative poverty in *Orchideæ* (6 species), and the entire absence of *Umbellifereæ*, of which order I failed to find a single species growing wild.

I have practically omitted all cultivated species which are neither truly wild nor escaped from cultivation.

Appended is a list of corrections to the first note. I regret that one or two errors in identification crept in.

In conclusion, I wish to here express my acknowledgments of the kind assistance and encouragement extended by Lt.-Col. D. Prain, I.M.S., F.L.S., and Capt. A. Gage, I.M.S., F.L.S.

SUPPLEMENTAL LIST OF PLANTS FROM NORTHERN GANJAM.

DICOTYLEDONES.

Menispermaceæ.

1. Cissampelos Pareira, *Linn.* Flowers rains, fruit December. *Uriya Okanobindu.*
2. Tinosporia cordifolia, *Miers. Uriya Gundichi.*
3. Cocculus villosus, *DC.*

Nymphæaceæ.

4. Nymphæa rubra, *Roxb.*

Capparideæ.

5. Cleome aspera, *Konig.* Flowers during the rains.
6. Capparis zeylanica, *Linn.*

Caryophyllaceæ.

7. Polycarpœa corymbosa, *Lamk.*

Portulacaceæ.

8. Portulaca oleracea, *Linn.*
9. Portulaca tuberosa, *Roxb.*

Elatineæ.

10. Bergia ammannioides, *Roxb.*

Malvaceæ.

11. Sida veronicifolia, *Lamk.*
12. Abutilon polyandrum, *Schlecht.*
13. Hibiscus ficulneus, *Linn.* Flowers cold season. *Uriya Bonobhendi.*
14. Hibiscus panduræformis, *Burm.*
15. Hibiscus vitifolius, *Linn.*

Sterculiaceæ.

16. Pentaptes phœnicea, *Linn.*
17. Melochia corchorifolia, *Linn.*
18. Waltheria indica, *Linn.*
19. Buettneria herbacea, *Roxb.*

Tiliaceæ.

20. Grewia orientalis, *Linn.*
21. Triumfetta rotundifolia, *Lamk.*
22. Triumfetta pilosa, *Roth.* Flowers cold season, up to 2,000′; only found in the southern extremity of the area.
23. Corchorus acutangulus, *Lamk.*
24. Corchorus fasciculatus *Lamk.*
25. Corchorus olitorius, *Linn.* An escape from cultivation. *Uriya Olusu*
26. Corchorus capsularis, *Linn.* An escape from cultivation.

Malpighiaceæ.

27. Aspidopteris Roxburghiana, *A. Juss.* Flowers during rains.

Geraniaceæ.

28. Biophytum sensitivum *DC.* Flowers during rains

Rutaceæ.

29. Murraya exotica, *Linn.*

Olacineæ.

30. Olax nana, *Wall.* Flowers hot season. *Uriya Bhumi-aonla.*
31. Opilia amentacea, *Roxb.* Flowers hot season. *Uriya Kau-bodelia.*

Celastrineæ.

32. Gymnosporia emarginata, *Roth.* Flowers cold season.
33. Gymnosporia Rothiana, *W. & A.*
34. Salacia prinoides, *DC.* Flowers November.
35. Hippocratea indica, *Wall.* Flowers during rains.

Rhamnaceæ.

36. Govania leptostachya, *DC.*

Ampelideæ.

37. Vitis tomentosa, *Heyne.*
38. Vitis repanda, *W. & A.*
39. Vitis auriculata, *Roxb.*
40. Vitis pallida, *W. & A.*
41. Leea herbacea, *Ham.*
42. Leea macrophylla, *Harnem.*

Sapindaceæ.

43. Hemigyrosa canescens.

Leguminoseæ.

44. Lathyrus satious, *Linn.* Escaped from cultivation.
45. Crotolaria quinquefolia, *Linn.* Flowers cold season.
46. Crotolaria medicaginea, *DC. var.* neglecta.
47. Crotolaria retusa, *Linn.*
48. Crotolaria mysorensis, *Roth.*
49. Flemingia semi-alata, *Roxb.*
50. Rhynchosia rufescens, *DC.*
51. Rhynchosia minima, *DC.* Flowers hot season.
52 Rhynchosia bracteata, *Benth.*
53. Teramnus labialis, *Spreng.* Flowers rains.
54. Mucuna monosperma, *DC.*
55. Millettia racemosa, *Benth.* Flowers rains.
56. Uraria lagopodes, *DC.*
57. Desmodium heterophyllum, *DC.*
58. Desmodium diffusum, *DC.* Flowers cold season.
59. Desmodium triquetrum, *DC.* Rare, only found near Mojjagodo. Flowers December.
60. Desmodium gyrans, *DC.*
61. Desmodium gyroides, *DC.*
62. Alysicarpus bupleurifolius, *DC.*
63. Indigofera aspalathoides, *Vapl.* Flowers and pods rains. *Uriya Nili.*
64. Indigofera trita, *Linn.*
65. Indigofera glabra, *Linn.*
66. Indigofera pulchella, *Roxb.* Not common. Flowers hot season.
67. Cassia pumila, *Lamk.* Flowers cold season.
68 Bauhinia acuminata, *Linn.*
69. Acacia lenticularis, *Ham.*
70. Acacia Suma, *Ham.*
71. Albizzia odoratissima, *Benth.* *Uriya Sirisi.*
72. Albizzia Lebbek, *Benth.* *Uriya Sirisa.*

Melastomaceæ.

73. Osbeckia zeylanica, *Willd.*

Lythraceæ.

74. Ammannia peploides, *Spreng.*
75. Ammannia pentandra, *Roxb.*
76. Ammannia baccifera, *Linn.*
77. Ammannia salicifolia, *Monti.*
78. Punica granatum, *Linn.* Planted.

Onagraceæ.

79. Jussiœa repens, *Linn.* Rooting in mud. Flowers soon after rains on the edges of tanks.

Turneraceæ.

80. Turnera ulmifolia, *Linn.* Introduced as a garden plant from America and now run wild and occurring as a common weed in the neighbourhood of towns. The order is only represented by this one species in India. and has been omitted from Hooker's Flora of British India, and is also absent from Cooke's Flora of Bombay, in which latter province it has perhaps not run wild as it has in Bengal (*vide* Prain's "Bengal Plants") and in our area.

Cucurbitaceæ.

81. Trichosanthes palmata, *Roxb.* Flowers rains.
82. Gymnopetalum cochinchinense, *Kusz.* Flowers rains.
83. Luffa acutangula, *Roxb.* Flowers rains.
84. Momordica Charantia, *Linn.* Flowers cold season. *Uriya Kobara.*
85. Momordica dioica, *Roxb.* Flowers rains.
86. Cucumis trigonus, *Roxb.* Flowers rains.
87. Citrullus vulgaris, *Schrad.* Run wild.
88. Mukia scabrella, *Arn.* Flowers rains.
89. Bryonia laciniosa, *Linn.*
90. Zehneria umbellata, *Thwaites.* Flowers hot season. *Uriya Mehada-noi.*

Trichosanthes anguina, *Linn.*; *Lagenaria vulgaris, Ser.*; *and Cucurbita maxima Duchesne* are much cultivated.

Ficoideæ.

91. Trianthema monogynum, *Linn.* Flowers rains.
92. Mollugo stricta, *Linn.* Flowers hot season.
93. Mollugo Spergula, *Linn.* Flowers hot season.
94. Mollugo hirta, *Thunb.* Flowers hot season.
95. Gisekia pharmaceoides, *Linn.* Flowers rains.

Rubiaceæ.

96. Dentella repens, *Forsk*
97. Hedyotis pinifolia, *Wall.*
98. Hedyotis hispida, *Retz.*
99. Oldenlandia Heynei, *Br.*
100. Oldenlandia brachiata, *Wight.*
101. Oldenlandia gracilis, *DC.*
102. Oldenlandia nudicaulis, *Roth.*
103. Randia malabarica, *Lamk.*
104. Knoxia corymbosa, *Willd.* Apt to be mistaken for an Umbelliferous plant at the first glance.

Compositeæ.

105. Centranthemum anthelminticum, *O. Kuntze.*
106. Vernonia teres, *Wall.*
107. Vernonia cinerea, *Less.*
108. Elephantopus scaber, *Linn.* Flowers at the end of rains and up to December.

109. Ageratum conyzoides, *Linn.* An introduced plant, now thoroughly established throughout the Peninsula and in Ceylon.
110. Grangea maderaspatana, *Poir.*
111. Erigeron asteroides, *Roxb.*
112. Blumea lacera, *DC.*
113. Lagera flava, *Benth.*
114 Sphœranthus indicus, *Linn.* *Uriya Pokusungo.*
115. Cæsulia axillaris, *Roxb.*
116. Vicoa auriculata, *Cass.*
117. Emilia souchifolia, *DC.*
118. Tagetes patula, *Linn.* An escape from cultivation.
119. Siegesbeckia orientalis, *Linn.* Only seen on the lower slopes of Mahendragiri.
120. Eclipta alba, *Hassk.* *Uriya Kasindra.* On dry soil a small procumbent dry weed ; much larger, erect and somewhat fleshy in swamps and ditches.
121. Blainvillea latifolia, *DC.*
122. Wedelia calendulacea, *Less.*
123. Spilanthes Acmella, *Linn.*
124. Bidens pilosa, *Linn.*
125. Glossogyne pinnatifolia, *DC.* In hilly country.
126 Tridax procumbens, *Linn.* *Uriya Bhumi—Pokusungo.* Another American invader which has become thoroughly naturalised throughout the Peninsula and Ceylon. It is certainly the most widespread and abundant weed in our area. It flowers sporadically throughout the year.
127. Launea pinnatifida, *Cass.* A small herb of the seashore sand with a flagelli form creeping and rooting stem.

At least three more species could not be identified for want of developed flowers.

Campanulaceæ.

128. Lobelia terminalis, *Clarke.*

Ebenaceæ.

129. Diospyros tomentosa, *Roxb.* *Uriya Khendu.* Not readily distinguishable from *D. melanoxylon,* Roxb. Both species occur.

Oleaceæ.

130. Jasminum Sambac, *Ait.*

Salvadoraceæ.

131. Azima tetracantha, *Lamk.* Flowers rains.

Apocynaceæ.

132. Vinca pusilla, *Mun.* A miniature of the introduced well-known "Dead man's flower." *V. rosea,* Linn.
133. Alstonia neriifolia, *Don.* Not common.

Asclepiadaceæ.

134. Cryptolepis Buchanani, *Rœm & Schalt.* *Uriya Doddara.*
135. Cryptolepis elegans, *Wall.*
136. Streptocaulon sylvestre, *Wight.*

137. Pentatropis microphylla, *W & A.*
138. Sarcostemma brevistigma, *Wight.* Flowers hot season.
139. Gymnema sylvestre, *Br. var.* ceylanica.
140. Pergularia pallida, *W. & A.*
141. Tylophora asthmatica, *W. & A.*
142. Hoya pendula, *Wight.*

Gentianaceæ.

143. Erythræa Roxburghii, *G. Don.*
144. Hoppea dichotoma, *Willd.*

Boragineæ.

145. Heliotropum ovalifolium, *Forsk.*
146. Heliotropum strigosum, *Willd. var.* brevifolia.
147. Heliotropum marifolium, *Retz. var.* Wallichii.
148. Heliotropum indicum, *Linn.*
149. Coldenia procumbens, *Linn.*

Convolvulaceæ.

150. Cuscuta reflexa, *Roxb.* A leafless filamentous parasitic shrub, often completely covering the crown of bushes with a matted yellow screen.
151. Evolvulus nummularius, *Linn.*
152. Jacquemontia paniculata, *Hallier, f.* (*Convolvulus parviflorus.*)
153. Merremia vitifolia, *Hallier, f.* (*Ipomœa vitifolia.*)
154. Merremia hastata, *Hallier, f.* (*Ipomœa angustifolia.*)
155. Merremia chryseides, *Hallier, f.* (*Ipomœa chryseides.*)
156. Ipomœa calycina, *Clarke.*
157. Ipomœa barlerioides, *Clarke.*
158. Ipomœa hispida, *Rom & Schult.* (*I. eriocarpa.*)
159. Ipomœa Nil, *Roth.* (*I. hederacea.*)
160. Calonyction muricatum, *Don.* (*Ipomœa muricata.*)
161. Lettsomia aggregata, *Roxb.*
Lettsomia aggregata, *Roxb. var.* *Osyrensis.*

I have adopted the nomenclature in Prains "Bengal Plants" entering that of the "Flora of British India" in brackets when the two differ.

Solanaceæ.

162. Solanum verbascifolium, *Linn.* Flowers hot season. *Uriya Donka-bejji.*

Scrophularineæ.

163. Limnophila conferta, *Benth.*
164. Limnophila racemosa, *Benth.*
165. Herpestes Monniera, *H. B. and K.*
166. Dopatrium junceum, *Ham.*
167. Vandella scabra, *Benth.*
168. Bonnaya reptans, *Spreng.*
169. Bonnaya veronicæfolia, *Spreng.*
170. Striga densiflora, *Benth.*
171. Striga euphrasioides, *Benth.*
172. Centranthera humifusa, *Wall.*

Lentibulariaceæ.

173. Utricularia reticulata, *Smith. var. uliginosa.*
174 Utricularia bifida, *Linn.*

Bignoniaceæ.

175. Dolichandrone falcata, *Seem.* Only two trees seen at the foot of the Mohiri hills near Jogidi. Flowers in June.

Acanthaceæ.

176. Elytraria crenulata. *Vahl.*
177. Nelsonia campestris, *R. Br.*
178. Acanthus ilicifolius, *Linn.* *Uriya Hollithikonti.*
179. Hygrophila polysperma, *T. And.*
180. Ruellia prostrata, *Lamk.*
Ruellia prostrata, *Lamk var dejecta.*
181. Ruellia patula, *Jacq.*
182. Hemigraphis hirta, *T. And.*
183. Phaylopsis parviflora, *Willd.*
184. Andrographis echioides, *Nees.*
185. Asystasia gangetica, *T. And.* (*A coromandeliana.*)
186. Rhinacanthus communis, *Nees.*

Verbenaceæ.

187. Lippia nodiflora.
188. Premna latifolia, *Roxb. var. mollissima*
189. Symphorema involucratum, *Roxb.*
190 Symphorema polyandrum, *Wight.*

Labiateæ.

191 Acrocephalus capitatus *Benth.*
192. Geniosporum prostratum, *Benth.*
193. Pogostemon plectranthoides, *Desf. Uriya Gondo-dulia.*
194. Leucas stricta, *Benth.*

Amaranthaceæ.

195. Amaranthus viridis, *Linn.*
196. Ærua Monsonia, *Mart.* On calcareous soils.

Chenopodiaceæ.

197. Basella rubra, *Linn.*

Polygonaceæ.

198. Polygonum plebejum, *R. Br.*
199. Polygonum glabrum, *Willd.*
200. Polygonum barbatum, *Linn*
201. Polygonum Hydropiper, *Linn.*

Loranthaceæ.

202. Viscum monoicum, *Roxb.*
203. Viscum orientale, *Willd.*

These leafy-species together with the various species of Loranthus in Uriya bear the generic name of Modango which is prefixed with the name of the host.

204. Viscum articulatum, *Burm. var.* dichotoma. *Uriya Madavi.*

Euphorbiaceæ.

205. Euphorbia hypericifolia, *Linn var.* indica
206. Euphorbia pilulifera, *Linn.*
207. Euphorbia microphylla, *Heyne.*
208. Bridelia retusa, *Spreng. var.* Roxburghiana
209. Bridelia montana, *Willd. var.* communis.
210. Bridelia stipularis, *Bl.*
211. Bridelia tomentosa, *Bl.*
212. Flueggia microcarpa, *Bl.*
213. Phyllanthus madaraspatensis, *Linn.*
214. Phyllanthus simplex, *Retz.*
215. Croton caudatus, *Geisel.* Not common.
216. Chrozophora plicata, *A. Juss.*
217. Baliospermum axillare, *Bl.*
218. Claoxylon Mercurialis, *Thwaites.*
219. Acalypha fallax, *Muell-Arg.*
220. Acalypha indica, *Linn.*
221. Homonoia riparia, *Lour.*

Tragia involucrata, *Linn. var.* angustifolia.
Tragia involucrata, *Linn. var.* cannabina.

222. Sebastiana Chamælea, *Muell.-Arg.*

Urticaceæ.

223. Trema amboinensis, *Bl.*
224. Pouzolzia indica, *Gaud.*

Pouzolzia indica, *Gaud. var.* alienata, *Wedd.*

225. Pouzolzia pentandra, *Benn.*
226. Phylochlamis spinosa, *Bur.*

Ceratophylleæ.

227. Ceratophyllum demersum, *Linn.*

MONOCOTYLEDONES.

Hydrocharideæ.

228. Ottelia alismoides, *Pers.*

Burmanniaceæ.

229. Burmannia cælestis, *Don.*

Orchidaceæ.

230. Geodorum dilatatum, *R. Br.* Terrestrial. Flowers rains.
231 Vanda Roxburghii, *Br.* A common epiphyte.
232. Habenaria platyphylla, *Spreng.*
233. Habenaria plantaginea, *Lindl.* } Small, terrestrial herbs.
234. Habenaria commelinifolia, *Wall.*

Hæmodoraceæ.

235. Sanseviera Roxburghii, *Schult. f. Uriya Marga.*

Amaryllideæ.

236. Curculigo orchioides, *Gærtn.*
237. Crinum asiaticum, *Linn.*

238. Crinum latifolium, *Linn.*
239. Pancratium zeylanicum, *Linn.*

Taccaceæ.

240. Tacca pinnatifida, *Forst.*

Dioscoreaceæ.

241. Dioscorea pentaphylla, *Linn. Uriya Koraba.*
242. Dioscorea tomentosa, *Kanig.*
243. Dioscorea oppositifolia, *Linn. Uriya Pitiolo.*
244. Dioscorea anguina, *Roxb. Uriya Kosa'lu.*
245. Dioscorea Hamiltoni, *Hook. f.*

All these flower during the rains. The tubers are eaten by the jungle tribes.

Liliaceæ.

250. Smilax macrophylla, *Roxb. Uriya Muthiri.*
251. Scilla indica, *Bak.*
252. Chlorophyton tuberosum, *Bak. Uriya Bonopia'z.*

Pontederiaceæ.

253. Monochoria hastæfolia, *Presl.*

Commelinaceæ.

254. Commelina nudiflora, *Linn.*
255. Commelina attenuata, *Kanig.*
256. Commelina suffruticosa, *Bl.*
257. Aneilema scapiflorum, *Wight.*
258. Aneilema vaginatum, *R. Br.*

Typhaceæ.

259. Typha angustata, *Chamb* and *Bury. Uriya Panitula.*

Aroideæ.

260. Pistia stratiotes, *Linn.* Flowers cold season. A small, rosette-like floating plant, common on all tanks.
261. Typhonium trilobatum, *Schott.*
262. Amorphophallus campanulatus, *Bl. Uriya Utlo.* The large tuber is eaten by the jungle tribes.
263. Plesmonium margaretiferum, *Schott.* The barren appendage is described as "nought or very short," but that of one specimen found was $1\frac{4}{5}''$ long, the total length of the spadix being 5″.
264. Scindapsus officinalis, *Schott.* An extensive climber.

Alismaceæ.

265. Limnophyton obtusifolium, *Miq.*

Naiadaceæ.

266. Potamogeton indicus, *Roxb.*
267. Potamogeton pectinatus, *Linn.*
268. Najas minor, *All.*

Eriocauleæ.

269. Eriocaulon truncatum, *Ham.*
270. Eriocaulon quinquœngulare, *Linn.*

Cyperaceæ and *Gramineæ.*

About 100 species of these two orders were collected and sent to Calcutta for identification. As they have not yet all been dealt with, they are entirely omitted here.

CRYPTOGAMIA.

FILICES.

Polypodiaceæ.

271. Adiantum lunulatum, *Burm.* }
272. Adiantum caudatum, *Linn.* } Two common " maiden hair " ferns.
273. Cheilanthes tenuifolia, *Swartz.*
274. Ceratopteris thalictroides, *Brogn.*
275. Hemionitis arifolia, *Bedd.*

Schiziaceæ.

276. Lygodium flexuosum, *Sw.*

RHIZOCARPEÆ.

Salviniaceæ.

277. Azolla pinnata, *R. Br.* A minute floating plant.

Marsileaceæ.

278. Marsilea quadrifoliata, *Linn.* }
279. Marsilea minuta, *Linn.* } *Uriya Sunusunnia sago.* Herbs creeping and rooting in mud. The " leaves " resemble those of Oxalis and are eaten. Conceptacles cold season.

LYCOPODINEÆ.

Lycopodiaceæ.

280. Lycopodium Hamiltonii, *Spreng.*

Errata to article on pages 537 *to* 556, *Vol. XV.*

Page 540—No. 63, *for* " carniculata," *read* " corniculata."

Page 542—No. 118, *for* " Crotolaria clavata, W. & A.," *read* " Crotolaria saltiana, Andr."

No. 127, *for* " Indigofera tinctoria," *read* " Indigofera sumatrana."

Page 543—No. 162, *for* " mungo," *read* " Mungo."

Page 544—No. 194, *for* " tora," *read* " Tora."

No. 199, *for* " absus, " *read* " Absus."

Page 545—No. 219, *for* " intsia," *read* " Intsia."

No. 226, *for* " catappa," *read* " Catappa."

No. 228, *for* " chebula," *read* " Chebula."

Page 546—No. 236, *for* " Guayava," *read* ' Guyava."

Page 548—No. 293, *for* " elengi," *read* " Elengi."

No. 297, *for* " embryopteris," *read* " Embryopteris."

No. 299, *for* " chloroxylon," *read* " Chloroxylon."

Page 549—No. 315, *for* " Chonemorpha Griffithii," *read* " Chonemorpha macrophylla, G. Don."

No. 321, *delete* Calotropis procera, Br., which does not occur.

Page 550—No. 367, *for* "Limnophila laxa, Benth.," *read* "Limnophila gratioliodes, R. Br."

Page 551—No. 373, *delete* "Uricularia affinis."

No. 388, *for* "Roinakka," *read* "Koïnakka."

Page 552—Nos. 396 and 397, *for* "Burleria," *read* "Barleria."

No. 401, *for* "Lepidagathis trinervia, Nees," *read* "Lepidagathis Hamiltoniana, Wall."

No. 402, *for* "betonica," *read* "Betonica."

No. 406, *for* "Justicia procumbesis, Linn., *read* "J. diffusa, Willd., *var.* orbiculata"

Page 553—No. 435, *for* "cephalotes," *read* "Cephalotes."

No. 457, *for* "tirucalli," *read* "Tirucalli."

No. 458, *for* "Euphorbia nivulia, Linn.," *read* "Euphorbia neriifolia, Linn."

Page 554—No. 467, *for* "Jatropha glandulifera, Roxb.," *read* "Jatropha gos-sypifolia, Roxb."

Page 555—No. 503, *for* "Agave Americana, Linn.," *read* "Agave cantuls. Roxb."

No. 493, *for* "susannæ," *read* "Susannæ."

A LIST OF THE BIRDS FOUND IN AND ABOUT MADRAS.

By D. Dewar, I.C.S.

This list is, I regret to say, by no means complete. Indeed, so full of lacunae is it that I should not have thought of sending it to the Journal, but for the fact that I am leaving Madras and am not likely to return to the station,—at any rate for some time to come.

So far as I have been able to ascertain no list of the birds found about Madras exists. I therefore venture to hope that this list, incomplete though it be, may prove of some service to bird-lovers, who happen in future to be stationed in Madras.

Now that a beginning has been made I hope that some ornithologist will ere long compile a complete list of the winged creatures seen in the neighbourhood of the chief town of the Benighted Presidency.

The present list was put together during the cold weather of 1904-05, which was an abnormal one on account of the total failure of the N.-E. monsoon. It is therefore tolerably certain that some wading birds will have to be added to those given below.

The opportunities I have enjoyed of going outside the immediate environs of Madras have been few, hence nearly all the birds herein enumerated are to be found within five miles of Fort St. George.

As, however, some of the birds that find place in this list were seen farther afield, I have taken as my area a strip of coast 10 miles broad extending from Chingleput on the south to the Pulicat lake on the north ; that is to say, an area of roughly 400 square miles. The Madras man who goes out for a day's shooting is not likely to go outside this area.

The number given against each bird is that attached to it in the Fauna of British India.

4. *Corvus macrorhynchus.*—The Jungle Crow.—The term "jungle crow" is a misnomer, for this bird affects town almost as much as *C. splendens* does. The two species are almost equally common within the Municipal limits of Madras. It is amusing to notice the respect with which this species is treated by *C. splendens*. It nests from March to June in Madras.

7. *Corvus splendens.*—The House Crow.—The bird is a positive pest in Madras. Their numbers must considerably exceed the human popu-

lation. Crowds of them hang about the General Hospital, rendering obligatory the entertainment of a special staff of "crow boys." These urchins are armed with bows and arrows, and they have their work cut out in keeping the crows out of the wards. The weak, helpless patients are a favourite butt of the crows. The tables, which are placed at the bedside of the patients, are provided with wire covers under which the food is placed. Formerly weaker covers were used, but the crows soon learned to overturn these. *C. splendens* nests in Madras during the months of June, July and August, usually in trees, but occasionally on roofs. Dozens of families are reared up annually in the trees of the Fort. Last year one pair tried to build on the telegraph wire near the General Post Office in Blacktown.

Both the cock and hen birds seek materials for the nest, but the female alone does the building. The male sits and watches in a tree near by, and when the female has adjusted the twigs to her satisfaction, both fly off together to seek new material. While the young are in the nest one or other of the parents invariably mounts guard. The young birds appear to remain about 20 days in the nest before they leave it. About the end of the third week of their existence they begin to sit on the edge of the nest, but do not attempt to fly until two or three days later.

They are fed by the mother and generally treated as babies for quite a long time after they have left the nursery. They "squawk" perpetually, displaying red throats.

The nest is usually built of twigs, but any flexible material is pressed into service. Cases are on record of nests in Madras being constructed of soda-water bottle wire, brandy-bottle wire and even bits of tin.

31. *Parus atriceps.*—The Indian Grey Tit.—This bird is by no means common in Madras.

111. *Crateropus griseus.*—The White-headed Babbler.—This is the common babbler of these parts, and indeed is the only babbler I have seen in the neighbourhood of Madras. Its habits are those of its class. It is, however, less untidy-looking. The degree of whiteness of the head varies greatly on different individuals. I believe that it is a case of "the older the bird the whiter the head." In newly-fledged birds the head feathers are scarcely whiter than the rest of the plumage. A young babbler makes a charming pet; it keeps up an endless cheeping twitter.

243. *Ægithina tiphia.*—The Common Iora.—This is one of the most abundant birds in Madras. Its multifarious and cheerful notes are heard in every garden.

278. *Molpastes hæmorrhous.*—The Madras Red-vented Bulbul.—Very abundant.

288. *Otocompsa emeria.*—Bengal Red-whiskered Bulbul.—This bird is sometimes seen wild in Madras. Probably birds which have escaped from captivity have established themselves. On one occasion I saw a young bird without the red patches on the side of the head. There appear to be several pairs in Guindy Park.

302. *Pycnonotus xantholæmus.*—Yellow-throated Bulbul.—Oates records this bird as having been found in Madras, but I think he must have been mistaken, for I have never seen it about Madras, nor do I know any one who has.

305. *Pycnonotus luteolus.*—White-browed Bulbul.—This bird occurs in great numbers, being in fact almost as abundant as *Molpastes.* It occurs in every hedgerow.

327. *Dicrurus ater.*—The Black Drongo.—Needless to say this bird is exceedingly plentiful. Numbers squat on the ground on the "Island" keeping company with mynas and grey-headed wagtails. It does not seem to "hit it off" very well with the latter, for one constantly sees it angrily chasing a wagtail, which it never catches.

The bird seems to breed throughout the hot weather. Last August a pair of drongos built their nest high up in a tree in the Fort within a dozen yards of my office window. As there were crows' nests on that and all the surrounding trees, the amount of squabbling that took place may be imagined. The screams of the irate king-crow were so loud and frequent that they seriously disturbed my work. On one occasion I took the trouble to count the number of fights between these two drongos and the various crows. Between 11-45 and 12-15 there were no fewer than 16 separate fights; and they kept this up throughout the day for 11 days!

330. *Dicrurus cærulescens.*—The White-bellied Drongo.—A rare bird. I can only remember seeing it on two occasions.

374. *Orthotomus sutorius.*—The Indian Tailor Bird.—Exceedingly abundant. Its nests are found from February to August. April is the month when most nests are likely to be seen. Single-leaf nests are

difficult to find. One pair sewed up one of the leaves of one of the numerous cannas that were growing in pots in the verandah of my friend, Mr. Powell. He noticed that the leaf was withering, so cut it off. He only then discovered that it contained a half completed nest. He replaced the leaf in the pot hoping the birds could continue nesting operations. But they left that nest and made another in the same plant.

I saw one nest only one foot above the ground, it was in the leaf of a canna standing on the steps of the Gymkhana Pavilion.

384. *Franklinia buchanani.*—The Rufous-fronted Wren-warbler.—A rare bird.

394. *Hypolais rama.*—Sykes' Tree-warbler.—Hundreds of thousands of these birds visit Madras in the cold weather; their harsh, sharp, *chick, chick*, seems to issue from almost every bush.

402. *Sylvia affinis.*—The Lesser White-throated Warbler.—Fairly common.

464. *Prinia socialis.*—The Ashy Wren-warbler.—This bird is not very abundant.

469. *Lanius lahtora.*—The Indian Grey Shrike.—There is a specimen of this bird in the Madras Museum, labelled "Madras," but I have not seen the bird in the neighbourhood.

473. *Lanius vittatus.*—The Bay-backed Shrike.—This is the common shrike of Madras.

476. *Lanius erythronotus.*—The Rufous-backed Shrike.—This is not common about Madras.

488. *Tephrodornis pondicerianus.*—The Common Wood-Shrike.—The bird occurs in great numbers in and about Madras, frequenting rows of palm-trees, and gardens. It has an agreeable mellow note which it constantly whistles.

500. *Pericrocotus peregrinus.*—The Small Minivet.—This bird is fairly common, little flocks of them frequently ornament the garden. When seeking the insect prey they often hang from a branch head downwards as Tits do.

508. *Campophaga sykesi.*—The Black-headed Cuckoo-Shrike.—This handsome bird is by no means rare in Madras, being more abundant there than in most parts of India.

510. *Graucalus macii.*—The Large Cuckoo-Shrike.—This bird can scarcely be said to be common about Madras.

512. *Artamus fuscus.*—The Ashy Swallow-Shrike.—This bird is not very common within Municipal limits, but is found in numbers all along the Buckingham Canal.

This bird keeps to tree-tops, now and again making little sallies into the air. Its wings when outspread resemble in shape those of a Bee-eater. Indeed the manner of flight of the Ashy Swallow-Shrike forcibly calls to mind that of the common green Bee-eater.

518. *Oriolus kundoo.*—The Indian Oriole.—This bird is not often seen in Madras during the hot weather, but is fairly common in the winter. Curiously enough I do not remember having heard its mellow note during the 18 months I was in Madras : on the other hand one frequently hears the bird's harsh note which is like unto the mewing of a wheezy cat. It would seem that the mellow note is uttered only during the breeding season, and that this species does not nest in Madras.

521. *Oriolus melanocephalus.*—The Black-headed Oriole.—This is far from being common in Madras.

528. *Pastor roseus.*—The Rose-coloured Starling.—This bird is not common about Madras.

532. *Sturnia menzbieri.*—The Common Indian Starling.—A bird rarely seen in Madras.

538. *Sturnus malabarica.*—The Grey-headed Myna.—A winter visitor only. In the cold weather it is fairly abundant. Its habits appear to be strictly arboreal. I do not remember ever having seen a Grey-headed Myna on the ground. It is frequently found in company with the Black headed Myna.

They occur in flocks and are noisy creatures. Their voices are harsh, the notes they emit being a hoarse cackle, like the commencement of the cry of the spotted owlet.

544. *Temenuchus pagodarum.*—The Black-headed or Brahminy Myna.—This is one of the commonest birds about Madras, being even more numerous than the following species.

Brahminy Mynas do not seem to be very particular as regards what they eat. Numbers of them will usually be seen in the neighbourhood of the conservancy trenches ! Last July a couple of these birds had a nest in the hole through the ledge or cornice of the spire of the Fort Church, through which the lightning conductor runs. Both parents feed the young ones.

549. *Acridotheres tristis.*—The Common Myna.

576. *Cyornis tickelli.*—Tickell's Blue Flycatcher.—I have never seen this bird at large in Madras. A live specimen was, however, brought to me last February and said to have been taken about 6 miles inland from Madras.

588. *Alseonax latirostris.*—The Brown Flycatcher.—This bird is by no means common in Madras. I have only noticed it in winter.

598. *Terpsiphone paradisi.*—The Indian Paradise Flycatcher.—This is the commonest Flycatcher in Madras and is a permanent resident. It sometimes enters verandahs and hawks insects from the trellis-work.

604. *Rhipidura albifrontata.*—White-browed Fantail Flycatcher.—This bird although not very abundant is by no means rare in Madras.

609. *Pratincola atrata.*—The Southern Pied Bush Chat.

644. *Ruticilla rufiventris.*—The Indian Redstart.—A good many of this species visit Madras in winter.

662. *Thamnobia fulicata.*—The Black-backed Indian Robin.—This bird is fairly abundant.

663. *Copsychus saularis.*—The Magpie-robin.—This bird, although by no means rare, is not nearly so abundant as it is in most stations of Northern India.

720. *Ploceus baya.*—The Baya.—I do not remember having seen this bird within Municipal limits; it is, however, by no means rare at a distance of a few miles from Madras.

728. *Uroloncha striata.*—The White-backed Munia.—This bird is not common in Madras.

734. *Uroloncha malabarica.*—The White-throated Munia.—This is the commonest Munia in Madras.

735. *Uroloncha punctulata.*—The Spotted Munia.—This bird is not very often seen about Madras.

775. *Gymnorhis flavicollis.*—The Yellow-throated Sparrow.—This bird is fairly abundant.

776. *Passer domesticus.*—The House-Sparrow.—This creature is as numerous and impertinent in Madras as elsewhere. The sparrow used to come inside the first hotel at which I stayed in Madras, and made such a noise that I was obliged to change my quarters.

813. *Hirundo rustica.*—The Swallow.

831. *Motacilla maderaspatensis.*—The Large Pied Wagtail.—This is the commonest Wagtail in Madras. It is a permanent resident; a pair

frequently attach themselves to a bungalow, and there bring up, in rapid succession, a number of families in a hole somewhere about the roof. This species has a sweet song.

832. *Motacilla melanope.*—The Gray-Wagtail.—This bird does not visit Madras in very larger numbers.

833. *Motacilla borealis.*—The Grey-headed Wagtail.—Great flocks of these birds visit Madras every cold weather. Their plumage is very variable.

839. *Limonidromus indicus.*—The Forest-Wagtail.—I saw this species on two occasions.

847. *Anthus rufulus.*—The Indian Pipit.—This bird does not appear to be very common.

861. *Alauda gulgula.*—The Indian Sky-Lark.—This is a common bird.

872. *Mirafra affinis.*—The Madras Bush-Lark.—As Jerdon remarks, this bird is to be found in every garden in Madras.

879. *Pyrrhulauda grisea.*—The Ashy-crowned Finch-Lark.—This bird is fairly common.

894. *Arachnechthra lotenia.*—Loten's Sun-bird.—This beautiful bird is very common in Madras. It has a fine voice. It nests in February and March. The nest is much more bulky than that of *A. zeylonica.* It is usually commenced upon a cobweb at the end of a branch of a bush. The entrance is protected by a porch. Two eggs are laid : these have a whitish background, blotched with brown ; the brown markings occur chiefly at one end of the egg.

895. *Arachnechthra asiatica.*—The Purple Sun-bird.—This bird is not nearly so common about Madras as *A. lotenia* and *A. zeylonica.*

901. *Arachnechthra zeylonica.*—The Purple-rumped Sun-bird.—This is the commonest of the three honeysuckers. In March, numbers of nests are to be seen. These are pear-shaped structures attached to the end of a low hanging branch. The branch is usually an inner one : so that the nest is likely to escape detection unless one passes under the foliage of the tree from which it hangs.

A pair of these birds built their nest at the end of a wire which hung down from the roof of a fernery. The occupants of the house used to take tea in the verandah every afternoon, within a couple of yards of the nest.

The branch to which another nest in the same garden was attached, broke and the nest fell to the ground. The broken end was then tied on to the tree by the owners of the garden, and the Sun-birds went on incubating as though nothing had happened.

933. *Pitta brachyura.*—The Indian Pitta.—This interesting bird may almost be said to be common in Madras. Wherever there is cover, such as shrubs or brushwood of any magnitude, there will this bird almost certainly be found.

Jerdon writes of the Pitta : "In the Carnatic, it chiefly occurs at the beginning of the hot weather, when the winds first begin to blow with violence from the west, and the birds in many instances appear to have been blown by the strong wind from the Eastern Ghauts; for, being birds of feeble flight, they are unable to contend against the strength of the wind. At this time they take refuge in huts, out-houses, or any building that will afford them shelter. The first bird of the kind that I saw, had taken refuge in the General Hospital at Madras and subsequently at Nellore. I obtained many alive under the same circumstances."

Some birds certainly reside in Madras all the year round, for there is not a month in the year in which I have not seen Pittas. They do not appear to be less abundant in the cold than in the hot weather.

They feed chiefly upon the ground, hopping about and rummaging among the dried leaves much as Babblers do. They are shy birds, making for cover directly they see a human being.

Crows, for some mysterious reason, appear to have a deep-rooted antipathy to Pittas ; this perhaps accounts for the wariness of the latter. Mr. D. G. Hatchell once picked up a dead Pitta in his verandah, which had presumably been killed by crows. Dr. J. R. Henderson relates a similar incident. "I was playing tennis at a friend's house here in Madras when I saw a bird being chased by a mob of crows. It took refuge in the drawing-room of the house, where I caught it and found that it was an uninjured, but very much terrified, Pitta." "My impression is," he adds, "that I have seen crows chasing a Pitta more than once in Madras." I have never yet had the good fortune to come across a Pitta's nest.

986. *Brachypternus aurantius.*—The Golden-backed Woodpecker.—This noisy bird is very common about Madras, where it seems to be very partial to toddy palm trees.

1003. *Iynx torquilla.*—The Common Wryneck.—This bird is not at all common about Madras.

1008. *Thereicery.x zeylonicus.*—The Common Indian Green Barbet.—I have neither seen nor heard this bird in Madras, but it has been described to me as occurring there. I have therefore included it in this list.

1019. *Xantholæma hæmatocephala.*—The Coppersmith.—This is one of the most abundant birds in Madras. Its monotonous note is heard continually throughout the day all the year round. Sometimes in the early morning during the winter months I have seen 70 or 80 of these birds sitting on one tree. I do not understand the significance of such conjugations, for they do not appear to occur on the same tree day after day. The tree that held them one morning was deserted the next.

1022. *Coracias indica.*—The Indian Roller.—This bird is not so abundant in Madras as it is in Northern India, but it occurs in some numbers.

1026. *Merops viridis.*—The Common Indian Bee-eater.—This bird is fairly abundant. I have not seen it breeding about Madras; it possibly goes elsewhere in order to bring up its family.

1027. *Merops philippinus.*—The Blue-tailed Bee-eater.—This bird is not very abundant within municipal limits, but one sees many of them when out snipe shooting; they are fond of sitting on the ridges which separate the flooded paddy fields.

1033. *Ceryle varia.*—The Indian Pied Kingfisher.—This is a very common bird.

1035. *Alcedo ispida.*—The Common Kingfisher.—This bird, too, is very numerous.

1044. *Halcyon smyrnensis.*—The White-breasted Kingfisher.—This species is even more abundant than the two above mentioned. It is found in almost every garden.

1046. *Callialcyon lilacina.*—The Ruddy Kingfisher.—Blanford says of this bird: "The specific name *coromanda*, although the oldest, cannot be applied to a bird that is not found in the Peninsula of India." But there can be no doubt that this bird is sometimes found in the Peninsula. There are in the Madras Museum three specimens of this bird, one of which was shot by Mr. Edgar Thurston, Superintendent of the Museum at Guduvancheri, about 16 miles south of Madras.

1067. *Upupa indica.*—The Indian Hoopoe.—This bird occurs in great numbers in Madras.

1073. *Cypselus affinis.*—The Common Indian Swift.—This swift is not very frequently seen in Madras.

1075. *Tachornis batassiensis.*—The Palm-Swift.—Thanks to the number of toddy palms this bird is very common in Madras.

1091. *Caprimulgus asiaticus.*—The Common Indian Nightjar.—I do not remember having heard this bird, but it does occur within Municipal limits, for Mr. D. G. Hatchell tells me that he has seen it in his compound.

1104. *Cuculus canorus.*—The Cuckoo.—It is only on very rare occasions that this bird visits Madras.

1109. *Hierococcyx varius.*—The Common Hawk-Cuckoo.—This bird does not often visit Madras. I can call to mind having heard its call but once during my 18 months sojourn in Madras.

1118. *Coccystes jacobinus.*—The Pied Crested Cuckoo.—This bird cannot be said to be abundant about Madras. Now and again one notices a noisy flock of pied crested cuckoos. The birds seem to be always on the move.

1119. *Coccystes coromandus.*—The Red-winged Crested Cuckoo.—This handsome bird is not very often seen in Madras. One was recently caught in the compound of Colonel Carruthers, I.M.S. He put it into his aviary. It was exceedingly shy. I have seen it in Guindy Park. It is probably commoner than is supposed. During flight it looks very like a cock koel.

1120. *Eudynamis honorata.*—The Indian Koel.—This bird is nearly as common in Madras as the grey-necked crow, and is proof positive that *Mrs. Corvus splendens* is a very good mother.

1130. *Centropus sinensis.*—The Crow-Pheasant.—This is a common bird ; one living in almost every garden of any size.

1138. *Palæornis torquatus.*—The Rose-ringed Paroquet.—A common bird, in the cold weather, it is much less frequently seen in the hot months.

1139. *Palæornis cyanocephalus.*—The Western Blossom-headed Paroquet.—This is not so common in Madras as the last species.

1152. *Strix flammea.*—The Barn Owl.

1157. *Asio accipitrinus.*—The Short-eared Owl.—This bird is, I think, fairly common. One usually comes across it while out shooting. I saw one bird sitting in the middle of the polo-ground about 4 p.m. It let me come within half a dozen yards of it before it flew away. It then settled down again on the polo-ground and made no attempt to conceal itself.

1161. *Syrnium ocellatum.*—The Mottled Wood-Owl.

1173. *Scops giu.*—The Scops Owl.

1180. *Athene brama.*—The Spotted Owlet.—This bird is, of course, exceedingly abundant.

1189. *Pandion haliaëtus.*—The Osprey.—Some of these fine birds are to be seen fishing in most of the backwaters in the neighbourhood of Madras.

1191. *Otogyps calvus.*—The Black Vulture.

1196. *Pseudogyps bengalensis.*—The Indian White-backed Vulture.

1197. *Neophrongin ginianus.*—The Smaller White Scavanger Vulture.—For the past 20 years or more a pair of birds (probably several pairs in succession) have brought up a family on a ledge of the steeple of the Scotch Kirk.

1207. *Hieraëtus fasciatus.*—Bonelli's Eagle.

1208. *Hieraëtus pennatus.*—The Booted Eagle.

1217. *Spilornis cheela.*—The Crested Serpent-Eagle.

1220. *Butastur teesa.*—The White-eyed Buzzard-Eagle.

1224. *Haliaëtus leucogaster.*—The White-bellied Sea-Eagle.

1228. *Haliastur indus.*—The Brahminy Kite.—This bird is exceedingly abundant.

1229. *Milvus govinda.*—The Common Pariah Kite.—This bird, too, exists in great numbers.

1233. *Circus macrurus.*—The Pale Harrier (?)—I am not certain as to the existence of this bird in the neighbourhood of Madras. One day when out snipe shooting I saw a bird of prey which I made out to be a pale harrier ; but it would not let me approach near enough for a shot.

1234. *Circus cineraceus.*—Montagu's Harrier.

1236. *Circus melanoleucus.*—The Pied Harrier.

1244. *Astur badius.*—The Shikra.

1247. *Accipiter nisus.*—The Sparrow-Hawk.

1249. *Pernis cristatus.*—The Crested Honey-Buzzard.—I have never-seen this bird in or about Madras ; but there is in the Museum a specimen which was shot on the Poona-Maler Road.

1255. *Falco peregrinator.*—The Shahin Falcon.—Mr. D. G. Hatchell shot one of these birds in his compound in Madras.

1260. *Falco subbuteo.*—The Hobby.—There is a specimen of this bird in the Madras Museum. But its label does not say where the bird was shot. However I have seen about Madras on two or three occasions a bird which I took to be a hobby.

1262. *Erythropus amurensis.*—The Eastern Red-legged Falcon.

1264. *Æsalon chicquera.*—The Red-headed Merlin.

1272. *Crocopus chlorogaster.*—The Southern Green Pigeon.—This bird is not at all common about Madras.

1292. *Columba intermedia.*—The Indian Blue Rock-Pigeon.—Not so abundant as in most places.

1304. *Turtur orientalis.*—The Rufous Turtle-Dove.—I have not seen this bird in or about Madras, but there is in the museum a specimen labelled " Madras."

1307. *Turtur suratensis.*—The Spotted Dove.—This is the common dove of the locality.

1309. *Turtur cambayensis.*—The Little Brown Dove.

1310. *Turtur risorius.*—The Indian Ring Dove.

1311. *Œnopopelia tranquebarica.*—The Red Turtle-Dove.

1317. *Pterocles fasciatus.*—The Painted Sand-Grouse.

1349. *Galloperdix spadicea.*—The Red Spur-Fowl.

1354. *Excalfactoria chinensis.*—The Blue-breasted Quail.

1355. *Coturnix communis.*—The Common Quail.

1356. *Coturnix coromandelica.*—The Rain Quail.

1357. *Perdicula asiatica.*—The Jungle Bush-Quail.—I have not come across either this or the next species, but Hume and Marshall state they have been found at Madras.

1358. *Perdicula argunda.*—The Rock Bush-Quail.

1375. *Francolinus pondicerianus.*—The Grey Partridge.

1395. *Rallina superciliaris.*—The Banded Crake.—A specimen of this bird in the Museum is labelled " Madras."

1401. *Amaurornis phœnicurus.*—The White-breasted Water-hen.—This is a rare bird about Madras ; as are the two following species.

1402. *Gallinula chloropus.*—The Moorhen.

1403. *Gallicrex cinerea.*—The Water-Cock.

1404. *Porphyrio poliocephalus.*—The Purple Moorhen.—The bird, usually called the purple coot, is fairly common about Madras.

1405. *Fulica atra.*—The Coot.

1416. *Sypheotis aurita.*—The Lesser Florican.—This bird is not at all common. Mr. Cross who goes out snipe shooting at least once a week during the season tells me that he rarely bags more than one florican a year.

1424. *Rhinoptilus bitorquatus.*—Jerdon's Courser.

1430. *Strepsilas interpres.*—The Turnstone.

1431. *Sarcogrammus indicus.*—The Red-wattled Lapwing.—Both this species and the next are very common about Madras.

1433. *Sarciophorus malabaricus.*—The Yellow-wattled Lapwing.

1441. *Squatarola helvetica.*—The Grey Plover.

1442. *Ægialitis geoffroyi.*—The Large Sand-Plover.

1443. *Ægialitis mongolia.*—The Lesser Sand-Plover.

1446. *Ægialitis alexandrina.*—The Kentish Plover.

1447. *Ægialitis dubia.*—The Little Ringed Plover.—Hundreds of these birds congregate on the mud flats at the mouth of the river Cooum, and on the island.

1450. *Hœmatopus ostralegus.*—The Seapie.

1451. *Himantopus candidus.*—The Black-winged Stilt.

1452. *Recurvirostra avocetta.*—The Avocet.

1454. *Numenius arquata.*—The Curlew.—This bird occurs in considerable numbers in all places where there is shallow salt water.

1455. *Numenius phœopus.*—The Whimbrel.

1456. *Limosa belgica.*—The Black-tailed Godwit.

1458. *Macrorhamphus semipalmatus.*—The Snipe-billed Godwit.—I have never seen this bird in Madras, but Jerdon records it.

1459. *Terekia cinerea.*—The Avocet Sandpiper.

1460. *Totanus hypoleucus.*—The Common Sandpiper.—This bird is very abundant about Madras and is, I believe, a permanent resident.

1461. *Totanus glareola.*—The Wood Sandpiper.

1463. *Totanus stagnatilis.*—The Little Greenshank.

1465. *Totanus fuscus.*—The Spotted Redshank.

1466. *Totanus glottis.*—The Greenshank.

1468. *Pavoncella pugnax.*—The Ruff and Reeve.

1471. *Tringa minuta.*—The Little Stint.

1474. *Tringa temmincki.*—Temminck's Stint.

1476. *Tringa crassirostris.*—The Eastern Knot.

1477. *Tringa subarquata.*—The Curlew Stint

1480. *Phalaropus hyperboreus.*—The Red-necked Phalarope.

1484. *Gallinago cœlestis.*—The Full Snipe.—This bird, together with the Pintail and Jack Snipe, visits Madras in very large numbers. Very excellent snipe shooting is obtainable all round Madras, both in paddy fields and tanks, during the whole of the cold weather. 50 couple is not an uncommon bag for one gun as the result of 6 or 7 hours shooting.

1485. *Gallinago stenura.*—The Pintail Snipe.

1487. *Gallinago gallinula.*—The Jack Snipe.

1488. *Rostratula capensis.*—The Painted Snipe.

1489. *Larus ichthyaëtus.*—The Great Black-headed Gull.

1490. *Larus ridibundus.*—The Laughing Gull.—This is the only Gull that is *common* about Madras.

1491. *Larus brunneicephalus.*—The Brown-headed Gull.

1492. *Larus hemprichi.*—The Sooty Gull.—A specimen of this bird, labelled "Madras," occurs in the local museum.

1498. *Hydroprogne caspia.*—The Caspian Tern.

1499. *Sterna anglica.*—The Gull-billed Tern.—This tern is very common about Madras.

1501. *Sterna media.*—The Smaller Crested Tern.

1502. *Sterna bergii.*—The Large Crested Tern.

1504. *Sterna melanogaster.*—The Black-bellied Tern.

1505. *Sterna albigena.*—The White-cheeked Tern.

1511. *Sterna saundersi.*—The Black-shafted Ternlet.

1527. *Phalacrocorax fuscicollis.*—The Indian Shag.—Some of these birds are to be seen on the Red Hills Tank.—Captain H. N. Packard describes it as breeding in December at the Vaden Tanjal tank near Chingleput.

1528. *Phalacrocorax javanicus.*—The Little Cormorant.—This bird is abundant on most of the large sheets of water round about Madras.

1529. *Plotus melanogaster.*—The Indian Darter or Snake-bird.

1538. *Puffinus chlororhynchus.*—The Green-billed Shearwater. I have never seen this bird, but Jerdon is supposed to have obtained a specimen in Madras, hence its inclusion in this list.

1545. *Platalea leucorodia.*—The Spoonbill.—This bird is not common in the neighbourhood of Madras.

1548. *Dissura episcopus.*—The White-necked Stork.

1549. *Xenorhynchus asiaticus.*—The Black-necked Stork.

1553. *Anastomus oscillans.*—The Open-bill.—Captain Packard describes this and the next species as breeding in December at the Vaden Tanjal tank.

1554. *Ardea manillensis.*—The Eastern Purple Heron.

1555. *Ardea cinerea.*—The Common Heron.

1559. *Herodias alba.*—The Large Egret.

1560. *Herodias intermedia.*—The Smaller Egret.

1561. *Herodias garzetta.*—The Little Egret.

1562. *Bubulcus coromandus.*—The Cattle Egret.

1565. *Ardeola grayi.*—The Pond Heron.

1567. *Butorides javanica.*—The Little Green Heron.

1568. *Nycticorax griseus.*—The Night Heron.—A considerable colony of these birds dwells in the Red Hills tank. These breed in August on some trees in the islands in the middle of the tank. Mr. Hatchell and I visited the island on 3rd September, but most of the young birds were fledged. We found one or two nests containing eggs and one holding a couple of young birds.

Captain Packard states that he saw thousands of these birds breeding at the Vaden Tanjal tank on 1st December. He says : "Some specimens of *N. griseus* were in very bedraggled plumage, it being evidently their second brood, and the young of the first brood appeared to be with them. Unfortunately I did not ascertain whether the Red Hills birds bring up a second brood in December."

1573. *Dupetor flavicollis.*—The Black Bittern.

1575. *Phœnicopterus roseus.*—The Common Flamingo.—A great colony of these birds visits the Pulicat Lake every cold weather : I must have seen over a thousand of them there. I am told that stray birds are sometimes seen on the Cooum at Madras.

1583. *Anser indicus.*—The Barred-headed Goose.

1584. *Sarcidiornis melanonotus.*—The Comb-Duck.

1588. *Casarca rutila.*—The Brahminy Duck.—Owing to the failure of the monsoon, the tanks about Madras did not fill this year ; hence very few ducks were seen. Moreover, I did not go outside Madras very frequently owing to the fact that the shooting was spoiled : so the list of ducks that follows is compiled from those in the Madras Museum which are labelled "Madras". I do not think that this is altogether trustworthy : for I understand that some of the specimens were purchased in the Moore Market. Upon this their claim to be called Madras birds is based.

1589. *Dendrocycna javanica.*—The Whistling Teal.

1591. *Nettopus coromandelianus.*—The Cotton Teal.

1593. *Anas pœcilorhyncha.*—The Spotted-billed Duck.

1595. *Chauselasmus streperus.*—The Gadwall.

1597. *Nettium crecca.*—The Common Teal.

1600. *Dafila acuta.*—The Pintail.

1601. *Querquedula circia.*—The Garganey Teal.

1602. *Spatula clypeata.*—The Shoveller.

1604. *Netta rufina.*—The Red-crested Pochard.

1617. *Podicipes albipennis.*—The Indian Dabchick.

MISCELLANEOUS NOTES.

No. I.—TIGERS HAMSTRINGING THEIR PREY BEFORE KILLING.

I have noticed a peculiarity in the way tigers in Burma kill their prey. On several occasions I have come across animals such as sambar, sine and gaur, also tame buffaloes that have been killed by tigers, and the method adopted seems to be to stalk the animal and suddenly bite one of the hind legs just above the hock, severing the tendon and breaking the bone, possibly in one bite. After this the tiger seems to follow the animal persistently, waiting for another chance, when it attacks the other leg and breaks it in the same way. Once both the hind legs are hamstrung and broken, the animal is helpless, when the tiger kills it easily, jumping on its back and biting the throat.

In March 1901, I found a tame buffalo in the Pegu river that had been killed by a tiger. The spot where the buffalo (a full-grown cow) died, was quite three miles from where it had been first attacked and one hind leg was broken. The Karen to whom the buffalo belonged showed me the spot where it had first been attacked. This was in some Kaing grass in the Pegu river. There were some ten buffaloes in the herd, and when the tiger attacked the one it eventually killed. the herd stampeded down the river, the wounded one following. The tiger followed the buffaloes for about two miles before it was able to get in another bite, when it broke the second hind leg. Even then the buffalo seems to have hobbled along after the herd for quite another mile before the herd left it and returned to the Karen Te. The Karens, finding that one buffalo was missing, went up the river to look for it, and found it just below the mouth of the Kadat stream. When found the buffalo was still alive with both its hind legs broken, and a part of one of the hind quarters eaten. The Karens returned to their Te intending to come next day to cut up the buffalo and eat it ; and although I was encamped at their Te, they would not tell me about it for fear I should want to sit up over the kill and should not let them eat it. About 2 o'clock in the afternoon I wanted some Karens to do some work for me, and finding that no one turned up I asked the reason for it, when I was told that nearly every one in the Te, men, women and children, had gone out to cut up a buffalo killed by a tiger. I asked the Ranger why I was not told of the kill, and he gave the reason I have given above. I was very angry and sent the Ranger off at once to tie up a machan over whatever was left of the kill. I followed myself an hour or so later, and on the way met the Karens returning laden with the flesh and bones of the buffalo. The Ranger made them leave the head and gut, collected them in one place in the bed of the river, and tied a machan in a tree on the opposite bank to that on which the kill had been.

When I got to the place, I found the machan ready. and as there was no time to tie another machan I just sat up in the one prepared. I had been sitting up for some time and it was beginning to get dark, when I saw the head of the tiger looking over the bank of a nulla on the opposite side of the river and about sixty yards off. He was evidently going to cross over to the remains of the kill and was looking to see if the course was clear before crossing, when a large fish jumped. This frightened the tiger who hurried round and was going up the bank when I had a hurried shot and missed.

On another occasion in the same year, I was out after a gaur in a forest, some thirty miles from where the buffalo was killed in the Pegu river, and a Karen informed me that during the previous evening he was out in his old "Ya" (cultivation) looking for vegetables when he heard a tiger roar and immediately after a gaur bellow, and said, he thought the tiger had killed a gaur. He would not come out with me himself but told my tracker where to go. My tracker had no difficulty in finding the place and the tracks of the gaur which we took up and followed. We had not been on the tracks ten minutes when we came suddenly on to a cow gaur which ran out of a clump of bushes, stood looking at us, and then moved off. The tracker said the herd must be near, and we were moving on, when from the same clump of bushes a gaur calf, about a year old, came tumbling out right on to us. We found that the poor beast had both its hind legs hamstrung and broken above the hock, and could not run away. This was the calf that had been attacked by the tiger the evening before, and the mother was standing over guarding it. My tracker wanted to take it home and try to cure it, but I saw it was useless attempting to do anything, and as the poor thing must have been in great agony, I put a bullet into it and finished it off. My tracker wanted me to sit up for the tiger, but as I had to hurry on to the next camp I could not do it.

On other occasions during the year 1902, I came across a sambur stag with very fine horns (for Burma) killed in the same way by being hamstrung first. I also found a cow sine and two cow gaur killed in the same way during the early part of this year. I was out after a gaur and had found the fresh tracks of what seemed to be a fair sized bull, and was following it up. The tracks being quite fresh, we expected to come up with the animal very soon. While we were going along very cautiously, my tracker noticed the pugs of a large tiger following the tracks of the gaur and drawing my attention to them, said " we are not the only ones after the gaur." He had hardly said these words when we heard a gaur bellow as if being attacked not far ahead of us. We hurried on as fast as we could, keeping to the tracks, hoping to come on to the tiger attacking the gaur, and in about ten minutes we came on to the place where the tiger had attacked the gaur This was in some thick young Dendrocalamus bamboo. The gaur was evidently going to lie up in this for the day when the tiger attacked it and broke one hind leg, as we could see from the way in which the gaur dragged one leg in walking ; we followed on the tracks of the gaur and tiger till late in the evening, the tracks leading us through the most awful thorn and cane jungle imaginable. We expected to come up with them every minute but were disappointed. My tracker said the tiger would follow the gaur till it got tired and would then get in another bite probably that night, when it would break the other hind leg and then kill its prey at its ease. My tracker also tells me that all the tigers in these parts kill the larger animals by first hamstringing them.

I should be glad to know if any other sportsmen have noticed this peculiarity in tigers in other parts of Burma and India ?

C. W. ALLAN, B.F.S.,
DIVISIONAL FOREST OFFICER,
Pegu Division.

PEGU, 15*th October* 1904.

No. II.—NESTING OF THE HOOPOE.

I took to-day the nest of the Indian Hoopoe (*Upupa indica*), and the account of it may interest you. The bird had chosen a hole in the stump of a big bough some twenty feet up in a large neem-tree. The hole went vertically downwards some two feet before the nest was reached. This consisted of a dead squirrel, all the flesh of which was completely dried up, but with a strong fetid odour. I took five fresh eggs, measuring as follows :— ·89 × ·67 ; ·92 × ·67 ; ·87 × ·64 ; ·87 × ·67 ; and ·90 × ·66. These were to all intents and purposes white ; only when placed beside a dead white egg is the faintest blue tinge perceptible. Other Hoopoe's eggs I possess are all distinctly pale blue, and are nearly all within ·02 of a full inch in length by ·69 in diameter.

This nest appears interesting in the light of the Hoopoe's reputation for liking a nest that smells, and also in reference to Pallas' statement that he "once found the nest of one within the exposed and barely decomposed thorax of a human body."

ARUNDEL BEGBIE, MAJOR,
(Indian Army).

CAWNPORE, 25*th March* 1905.

No. III.—FOOD OF PREDACEOUS FLIES.

Walking through a forest some 45 miles due east of Bilimora Station my attention was attracted to a living bundle that fell buzzing and tumbling off a tree. Rushing up and pouncing on it I found my prisoners to be a large Cicada in the clasp of a fly of the *Asiliidæ*. The Cicada's body measures $1\frac{1}{4}''$ long and $\frac{6}{10}$ths wide at shoulder. He is consequently a very powerful insect.

The fly had him on his back, his short beak buried in the other's chest, and showed no disposition to let go whilst the pair were transferred to a handkerchief. Later, he changed his suction-point to the shoulder.

The fly was about the same length, but probably not a tenth of the weight. He was given another live Cicada the third day and pierced it in the chest, but he would not look at other flies and bees.

F. GLEADOW, I.F.S.

BANDORA, NEAR BOMBAY, *April* 1905.

No. IV.—OCCURRENCE OF WHITE'S THRUSH (*OREOCINCLA VARIA*) IN ASSAM.

I have this year obtained several specimens of *Oreocincla*. The other day in going through these I noticed one which appeared to be very much larger than the rest. I accordingly sent the bird to Mr. E. Stuart Baker, F.Z.S., who identified it as being White's Thrush (*Oreocincla varia*), an unknown bird, I believe, within Indian limits. The bird was obtained on the 12th February 1905, and was shot in Ekra jungle in the Dibrugarh District.

Mr. E. Stuart Baker writes as follows:—

> "The above bird was sent to me for identification by Mr. Moore. It is undoubtedly a fine specimen of *Oreocincla varia*, having a wing of 7·1″ as against only 5·3″ to 5·6″ of *Oreocincla dauma*. The only other specimen of the bird ever procured in British Indian limits is that mentioned by Oates (*"Fauna of British India"*—*Birds*—Vol. II., p. 153.) as having been procured by Wardlaw Ramsay at Toungngoo n 1876. During the last 30 years I can find no record of its having been noticed. It is a fairly common Chinese bird extending to Japan."

WM. MOORE.

DIBRUGARH, 29*th March* 1905.

No. V.—HEREDITARY MELANISM.

We have a pair of black panthers here. They were purchased about 2½ years ago from a man who said that he had brought them from North China? They are male and female and have twice bred together in captivity since their arrival in Kolhapur; on both occasions the cubs (two in number) were quite black like the parents.

On another occasion when the male black panther mated with a panther of the ordinary variety there was only one cub as a result and he was very beautifully marked, the spots being larger, blacker and more glossy than usual, and the peacock-eyes altogether larger and more defined; he is here still and quite full grown.

These panthers appear to me to be a distinct species and not a freak in melanism. Ordinarily they appear quite black like the domestic cat, but if viewed with the light shining on the coat, the spots and markings are distinctly visible.

W. B. FERRIS, LIEUT.-COL.

THE RESIDENCY, KOLHAPUR, S. M. COUNTRY.
10*th April* 1905.

No. VI.—CURIOUS FEROCITY OF THE INDIAN TREE-PIE (*DENDROCITTA RUFA*).

Yesterday afternoon Lieutenant H. H. Smith, of the 10th Jats, saw an Indian Tree-pie (*Dendrocitta rufa*), attack a young brown-backed Indian Robin (*Thamnobia cambaiensis*) which was feeding on the ground.

The Tree-pie bit the Robin's head clean off and ate it, afterwards proceeding to try and tear other parts off the body. It had partially got rid of the right wing, when the observer interfered, and secured the body to show me. *Dendrocitta rufa* is very plentiful here, as are also fruit trees, and I have never seen one feed on anything but fruit.

ARUNDEL BEGBIE, MAJOR.

CAWNPORE, *4th May* 1905.

No. VII.—BREEDING SEASONS OF BIG GAME.

I.

THE NILGAI OR BLUE-BULL (*Boselaphus tragocamelus.*)

I saw a herd of three Nilgai cows yesterday in the Thasra Taluka. All three had calves between one and two months old.

C. W. M. HUDSON, I.C.S.

CAMP KAIRA, *15th January* 1905.

II.

THE PERSIAN GAZELLE (*Gazella subgutturosa.*)

Vith reference to Mr. E. Comber's letter, dated 12th September 1904, published on pages 178 and 179 of this Society's Journal, Volume XVI., No. 1, which was kindly sent over to me for perusal by Colonel A. H. McMahon, C.S.I., C.I.E., you might think the following facts in regard to the Persian Gazelle (*Gazella subgutturosa*) sufficiently interesting for record. The first is that the Persian Gazelle is definitely known to breed during the months of December and January. A Bugti shikari belonging to the Seistan Mission Camp, between the 13th December 1904 and the 16th January 1905, when the Mission was encamped on the Farrah Rud, not only saw does accompanied by young fawns on more than one occasion, but out of sixteen Gazelle which he shot, found on examination, that all the females (five in number) were carrying young.

The other item of interest is that the Persian Gazelle ordinarily gives birth to two fawns at a time, as was found to be the case in all the instances referred to above.

J. W. NICOL CUMMING,
SUPERINTENDENT, SEISTAN ARBITRATION MISSION.

SEISTAN, *via* QUETTA, *6th May* 1905.

No. VIII.—STRANGE MORTALITY AMONGST TERMITES IN TEA-BUSHES.

I am sending you some specimens for exhibition at your next meeting with a view to obtaining suggestions from other members who may have observed the same phenomenon. The specimens were sent to me by Mr. H. L. Andrewes.

a tea planter in the Nilgiris. The following extract from his letter will explain the specimens and the circumstances under which they were found :—

> "April 13th 1905. I found rather a queer thing in the tea to-day and am sending you specimens. As you will see—if they arrive in decent condition—it consists of dried up termites stuck on tea shoots and the ends of stalks which have been plucked and on the edges of leaves. There were thousands of them on several bushes, all stuck by a darkish shiny liquid. My theory is that, owing to the excessive drought (this being the sixth month since we have had any rain), they came up to get liquid for purposes of their own—perhaps for nest building, and that the tea juice made them sick, and there they stayed until it dried and so got stuck. The tea has only just been tipped after a prune. They certainly did not try the tea as food, for the ground is covered with twigs. I cannot see any signs of the leaves or shoots having been bitten, so that they must have been upset directly they stuck their jaws in. Several, by the way, are fixed to the edges of leaves by their jaws. They were thickest on the points of buds, and in regular lumps on the ends of plucked shoots, and there were a good many scattered round the edges of leaves."

Many insects, when attacked by disease, will climb up and attach themselves to the summit of growing plants before dying. But I have carefully examined these termites and can find no trace of fungal or bacterial disease. It is noticeable that they are all "soldiers," and would therefore not have been occupied in nest building. It looks like a case of concerted suicide ! I have never seen anything like it in this country.

E. ERNEST GREEN.

PERADENIYA, CEYLON, 19*th May* 1905.

No. IX.—SIZE OF SNAKES.

Last Friday night I killed a Phoorsa (*Echis carinata*) that was moving round the dinner table. As it appeared to me to be of unusual size, in fact by far the largest I had seen, I thought it as well to measure it and it proved to be exactly 2 feet 6 inches in length. It was a very handsomely marked specimen, having apparently recently sloughed its skin.

L. C. H. YOUNG.

ANDHERI, NEAR BOMBAY, 25*th May* 1905.

No. X.—A CONGREGATION OF HARRIERS.

What struck me as rather a curious sight, may be of interest to some of the many readers of this Journal. Whilst going through the Jeypore hills in the Vizagapatam District last February (the 13th to be exact), I was attracted by seeing numbers of these hawks flying in the same direction, past my camp, over the crest of an adjacent hill, where they all appeared to circle once or twice and then disappeared from view the other side. Curious to know the meaning of it and having nothing to do, I made for the top of the hill and on reaching it found myself on rather an extensive plateau, which bore signs of not very recent cultivation, but with the exception of a few straggling bushes, and many stones, was now as bare as a street of any verdure.

Here, to my surprise, I saw crowds of Harriers sitting on stones and on the ground and more were coming from every direction.

It was already late in the afternoon so I got behind a convenient bush and decided to wait and see whether they meant to stop the night there. Before sitting down, however, I strolled through a part of the ground, flushing several of the birds, which did not go far, to see if I could see any signs which would point to this being a regular roosting place of these birds, but to my surprise found none, or at any rate not sufficient to lead me to believe they had been there in any numbers before. I returned to my bush and hid myself as best I could, though concealment was not very necessary, as the birds would allow me to within 30 or 40 yards without rising. I had fortunately brought a pair of powerful Zeiss binoculars with me, so could take careful stock of all the ground before me. I was easily able to identify 3 different species among them and of some I was doubtful, but they may have been youngsters in a transition stage of plumage, so not easy to identify at any distance.

Circus æruginosus (the Marsh Harrier) perhaps was the most numerous, then came *C. macrurus* (the Pale Harrier) and *C. melanoleucus* (the Pied Harrier) last. I only noticed 2 males of the latter species.

Next morning I had to pass the hill and was in time to see them making a move. It was evidently not migration they were after (it was rather too early in the year for that in any case), as they scattered in all directions.

Can any one tell me if it is customary for Harriers to roost in flocks like this on the ground ?

I have neither read nor heard of them doing so and certainly never seen them do so before.

C. H. DONALD.

BHADARWA, KASHMIR, 15*th May*, 1905.

No. XI.—SIZE AND BREEDING OF SNAKES.

A PYTHON FROM BORNEO.

Mr. John Hagenbeck recently received a large python from the Malay Archipelago (probably from British North Borneo), which laid a batch of eggs after its arrival in Colombo and incubated them herself with success, some thirty or forty young hatching out in due course.

The following notes have been kindly supplied by Mr. Hagenbeck :—

COLOMBO, *January* 20*th*, 1905.

A gigantic python which arrived here last year from British Borneo *via* Singapore laid about one hundred eggs, on the 28th October, almost filling the box in which she was kept. On the following morning she had collected the eggs, by skilful coiling of her body into a large heap which she completely covered in such a manner that the weight of the body exerted no pressure upon the soft-shelled eggs.

In order to maintain a constant temperature the snake slightly uncoiled herself from time to time so that the eggs became visible, thus regulating the temperature.

During the period of incubation I offered ducks, fowls, and geese to the python, but she refused all nourishment.

On the 14th January she left the mass of eggs quite exposed, and I had given up the hope of a successful issue when I discovered the first nestling with half its body emerging from the egg, into which, however, it retired again towards evening.

By the next day, 15th January, six young snakes, had hatched out, of which some died, while others were very active, making darts at a cloth held near them.

The period of incubation, lasted exactly two-and-a-half months. The young measures from two to two-and-a-half feet long, and have now been moved away from the parent into another box where they continue to increase in size without having fed meanwhile.

Altogether forty-five young have been recovered from the clutch. Of these, thirty-six still survive, which I shall attempt to rear, feeding them with frogs and small lizards.

So far as can be ascertained, the parent python measures about 28 feet in length and weighs 250lbs.

JOHN HAGENBECK.

(*From* "*Spolia Zeylanica*," *March* 1905.)

No. XII.—TIGER *versus* BEAR.

In Miscellaneous Notes No. IV. (Vol. XV, No. 4, page 707,) Tiger *versus* Bear, Capt. Lane asks if there are other instances of tigers attacking bears.

Some 5 or 6 years ago at the end of the monsoon when the grass was rank and long, I had been out stalking at Castle Rock.

My shikari was with me and on our way home we came down a hill path through heavy jungle and noticed various not quite fresh signs of a tiger having been on the path. When we got to the bottom the jungle ended in a grassy glade and within a few yards of the track, the grass had been trodden down in a circle some 20 feet in diameter, I should think. Tufts of hair and bits of skin and hair of the Indian Sloth Bear were strewn about in the circle, and it was evident a struggle had taken place in which the bear had suffered badly. It was also evident that a body had been dragged away, and following the track for a short distance we found under a bush the remains of the bear consisting of part of the skull and various other bits of bones, which, from their condition, must, I think, have been there some 2 or 3 days.

I cannot remember if we found tiger's hairs in the circle, but the hair and skin of the bear had evidently been scratched off, and I left the place convinced that a tiger had attacked, killed, and eaten the bear.

G. K. WASEY.

CHILTON FOLIAT RECTORY,
HUNGREFORD BERKS, May, 1905.

No. XIII.—PLUCKY PEE-WITS.

One morning when out riding at Deoli, Rajputana, during the early part of the rains in 1898 my attention was attracted to the unusual behaviour of two Pee-wits. One of the birds was flying backwards and forwards in much excitement and constantly swooping to the ground close to where the other bird was dancing about screaming. On coming closer I saw that the cause of all the commotion was a large snake. I dismounted, and went for the snake which dropped an egg it was about to swallow and made off *ventre a terre.* I succeeded, however, in catching it up in about 20 yards and killed it with my riding cane, breaking a second egg about a foot or so down its gullet in so doing. A bulge in the snake's body made by a third egg, also broken, was plainly visible.

I then returned to where the fracas between the Pee-wits and the snake had taken place and soon discovered the nest with the fourth and last egg still reposing in it close by unharmed. The eggs had not long been under incubation judging from the condition of the egg broken by me in killing the snake. I replaced the egg which the snake dropped when I first attacked it in the nest, but unfortunately circumstances prevented me from revisiting the spot to ascertain whether the pluck displayed by the Pee-wits in the protection of their hearth and home was followed by an equal fortitude in carrying on their nesting operations there after so rude a shock to their nervous system.

The foresight displayed sometimes by Pee-wits in the selection of sites for their nests was also impressed upon me once on another occasion.

I was stopping in the Dâk bungalow at Mandsaur, Central India, for a day in July 1903, when over 3 inches of rain fell in the course of a few hours. The whole compound practically was under water after the rain closed, except a small square foot or so of ground on the highest part of which a Plover sat serenely throughout the flood. To the ordinary eye there would have been no indication in the absence of this practical test that this particular patch was on a higher level or better drained than the rest of the Dâk bungalow enclosure.

J. MANNERS-SMITH, MAJOR, V.C., C.I.E.

NEPAL, 28*th May*, 1905.

No. XIV—NOTES ON THE OCCURRENCE OF BONELLI'S EAGLE (*HIERAËTUS FASCIATUS*) IN CUTCH AND ON SOME FALCONS AND HAWKS OBSERVED AT THE OLD FORT AT BHUJ.

Has Cutch been generally considered to be one of the districts frequented by Bonelli's eagle (*Hieraëtus fasciatus*)?

I have not seen its occurrence there recorded, although it seems to be far from uncommon.

When I first arrived in Cutch, in February 1904, I daily saw a pair of Bonelli's eagles flying high over the old fort at Bhuj, and I was able to watch them a good deal as my bungalow was at the foot of the hill, on the top of which the fort, or rather a portion of it, is built. They were sometimes accompanied by a handsome very rufous coloured young female, whom I also often saw by herself. Soon after my arrival one of my falconers caught the old male, using a hare as a bait, but two days later I let him go, and he rejoined his mate, after which the two continued to fly over the fort regularly just as if nothing had happened. I saw them at odd times during the day now and then, but their regular hours for soaring over the fort were from 5 P. M. till dark and they used to turn up between 5 and 5-30 P. M. with great regularity, particularly during the hot weather.

From March to October there is always a steady south-west wind blowing at Bhuj (*i. e.*, from my bungalow towards the fort). The result of this was that the eagles in order to face the wind invariably came up flying slowly against the wind from the north-east side of the fort and usually high over it until they were a couple of hundred yards or less south-west of it, where they took up their position, becoming apparently motionless, head to the wind. After this they sometimes slightly changed their position and became steady again.

Sometimes they went on like this till dark. The pair always flew quite close to each other, usually side by side. If the young one was with them she generally kept some distance away, and went away altogether before long.

Occasionally when the old pair were soaring in this manner, one of them would suddenly fly forward beating hard with its wings for a short distance, then turn over, shut them tight, and come down in the most magnificent stoop. I often could not see what it was after, but when I did, it was as a rule a pigeon, once a crow, and on another occasion a hare which was killed.

Whenever one eagle started off in pursuit of anything like this, the other invariably followed immediately behind, and if the first stoop missed, No. 2 coming along behind, often killed.

I have seen them chase the blue-rocks, of which there are a great number about the fort, but never saw them succeed in catching one though I saw one or two apparently narrow shaves.

Tame pigeons they killed a great number of—a good many of mine too.

I sometimes went on to the top of the fort with a pigeon in my pocket, and when the eagles came well over I let the pigeon go. I saw one or two very fine flights this way occasionally quite close.

In April 1904 I caught the handsome young eagle. She became fairly tame, but I regret to say died a few months later. I did not attempt training her, as I had no time to do so myself, and my falconers with whose assistance I might have made the experiment were all away at the time.

In August or September I thought I should like to get rid of these eagles, as I was expecting my trained hawks from the Punjab, and intended doing a good deal of hawking in the country round. I was afraid of the Bonelli's interfering with my hawks, as these eagles will invariably go for any hawks which they have seen kill anything, no matter how far off, to rob them. There is danger of their killing a trained hawk if they surprise it when busy with its quarry, and a much greater danger of the trained hawk bolting clean away out of sight and being lost, on the sudden close appearance of an eagle and particularly Bonelli's eagle.

As I did not want to kill the Bhuj eagles, I set one of my falconers who arrived ahead of the others to catch them, intending to let them go as soon as the hawking season was over.

Up to this time I had regularly seen one pair of Bonelli's eagles over the fort and never any others.

The falconer soon caught the female which was a very handsome one with a snow white breast except for some marking on it. To my great surprise two days later there was again a pair over the fort at 5 p. m. as before. The following day I went out with my man and he caught the male (in the presence of the new female). A few days later there was again a pair, who appeared daily as regularly as the original pair had done, but only for 2 or 3 days, when by an accident both mine escaped, and went straight back to the fort. After this I used often, though not daily any more, to see a pair of these eagles over the fort, but never more than a pair. They stayed much more on the other side of the fort now, and I suppose that it must have been the original pair again, rather scared after having been caught. The new pair had either gone off of their own accord on the return of the old pair, or by a little gentle persuasion, though I never saw any quarrel.

I shot a very fine young rufous coloured Bonelli when out hawking 5 miles from Bhuj in January 1905. On another occasion we were flying a young peregrine (*Falco peregrinus*) at a houbara (*Houbara macqueeni*) for the first time. She went apparently very keenly at it, knocked a lot of feathers out of it, and then left it, rather to my surprise. The houbara went on a bit sick, when suddenly I saw a big female Bonelli coming along at a good height, till she was perpendicularly over the houbara, when she turned, stooped straight down and killed it. She flew off as I came up, so I got the houbara after all.

I have seen a great many different kinds of birds of prey about the old fort at Bhuj and I suppose there is hardly another place where they show off themselves and their flying powers better. Ordinarily the only chances one has of observing the flying capabilities of hawks and falcons, are when one of them happens to chase some bird near you out shooting or riding, when you probably only see the hawk for a few minutes or even seconds and rarely more than one at a time. But at Bhuj you can often watch two or three falcons playing about together in the wind, stooping at each other and chasing birds, and the performance often goes on for an hour or two. Even by keeping trained falcons and flying them often, one never or rarely sees anything like this, as the best trained hawks can never equal wild ones in flying, though it is wonderful what they can do, considering the small amount of exercise they must necessarily be dependent on.

I think that the strong breeze almost always blowing over the fort at Bhuj is the chief attraction to the eagles and falcons, who come there to soar in and enjoy it. The fort is on a hill about 500 feet high and these birds generally cruise about over it at varying heights. I have seen as many as six laggar falcons (*Falco jugger*) playing about there at the same time, stooping at each other and at rats, lizards and flying insects, dragon-flies, &c., which seem to be their principal food.

Laggars do not seem to take birds very often, though of course they do so sometimes, and I have seen them after blue-rock pigeons at Bhuj.

When flying over the fort the Laggars always kept very much on the move. They never hovered like the eagles but kept dashing about all over the place, high over the fort at one moment, down on the ground the next, away over the city half a mile distant and back over the fort again a few seconds later, and so on.

During the whole of the hot weather I saw no Shahins *(Falco peregrinator)* only Laggars, but in October the Laggars disappeared, after which I rarely saw them, but Shahins took their place, though I did not see very many of these. Their flying was simply grand. They went on in a very similar manner to the Laggars, only they flew ten times as fast when putting on the pace, and their whole style and manner of flying was most strikingly superior.

I believe that Hobbies have been stated to be the swiftest of hawks. I very much doubt their being able to even approach Shahins and Peregrines in speed.

My father, who hawked in India for many years and a good deal at home too, with every trainable kind of hawk, used often to state this as his opinion, and now that I have had a good many opportunities of watching Hobbies, Peregrines and Shahins both in this country and in China, I believe that Hobbies cannot compete with the larger falcons at all, beautiful fliers though they are.

A little Shahin Tiercel that I often saw at Bhuj used to travel something like a shell through the air. He went so fast you could hardly follow him with your eyes if he passed close, and he made a loud swishing noise that you could hear a couple of hundred yards away. I have seen him stoop a length of several hundred yards at a flock of small birds, get one and carry it up high over the fort, eat it on the wing and go on playing about and actually stoop at others, with one already in his foot. I did not see him take a second when he already had one, and I suppose he did this only from high spirits and not in real earnest.

The Peregrine Falcon is uncommon in Cutch, and I see it is not included in Capt. Lester's List of the birds of Cutch. As long as I was there I only saw one, which my falconer caught and trained and which is now in my possession.

The Red-headed Merlin is one of the commonest hawks in Cutch, but they did not frequent the fort nearly as much as the other hawks. They perch more and soar less than other hawks I think. Kestrels I often saw over the fort, and Shikras, which are as common at Bhuj as everywhere in India, frequently soared there too. I also occasionally saw the Sparrow Hawk (*Accipiter nisus*) there, one of which my falconer caught, but it was not a good one and we let it go.

The Booted Eagle (*B. pennatus*) is frequently to be seen at the fort in the cold weather and the Tawny Eagle (*A. vindhiana*) is very common in Cutch and was a constant nuisance to us out hawking. I shot several.

One day when we were out in camp near Bhuj, I saw a Shahin coming along straight for our tents carrying a fairly big bird. It was followed at about 100 yards distance by a Tawny Eagle, who appeared to be neither gaining nor losing. He was a good deal lower down than the falcon. When the latter had just passed us she dropped her bird and the eagle turning, stooped and caught it before it reached the ground.

I expect these eagles get a large portion of their living in this way by robbing hawks and falcons of their prey.

A. DELMÈ RADCLIFFE,
105th L. Infy.

KARACHI, *5th June* 1905.

No. XV.—OCCURRENCE OF THE BLACK-CAPPED KINGFISHER (*HALCYON PILEATA*) IN THE GODAVARI DELTA.

(A CORRECTION.)

On page 373 of this volume a note was published giving the "occurrence of Black-capped Kingfisher (*Halcyon pileata*) in Waltair." This locality was a mistake on the Editor's part, as Waltair is very far from the Upputeru River, where I found the bird. I have never seen *Halcyon pileata* near Waltair and do not think it likely it occurs there. The Upputeru flows from the Koleru (not Kolem) lake, and the name of the village where I first saw the Kingfisher is Naidupalem (not Naidupatem). Considering the notes on the distribution of this species in Blanford's book, its occurrence on the east coast seems worth correctly recording.

I may here mention that I saw another of this species on the Yeleru drain near Cocanada on the 13th February last. It thus does not seem to be uncommon in the Godavari Delta.

P. ROSCOE ALLEN.

CAMP BURGAVALSA, MADRAS PRESIDENCY,
2nd June, 1905.

No. XVI.—ON THE OCCURRENCE OF THE LADY AMHERST'S PHEASANT IN BURMA.

The Society lately received a skin of an adult male specimen in full plumage of the Lady Amherst's Pheasant (*Chrysolophus amherstiæ*) from Lieut. W. W. Van Someran, who shot it at a height of about 9,000 feet near Sadon in the Myitkyina district of Upper Burma.

As this is apparently the first recorded specimen that has been obtained within British Indian limits as recognised in the 'Fauna of British India' the species may now take its place in the list of our birds.

As regards the known range of the species the Cat. Brit. Mus. (Birds, Vol. XXII) merely gives the habitat as "the mountains of Western China and Eastern Thibet" and Elliot's Monograph of the *Phasianidæ* (1872) names "China bordering on Eastern Thibet and Yunnan to the province of Setchuen." In the published account of the Zoological researches of the Yunnan expeditions of 1868 and 1875, the occurrence of the species is noted "on the hills between Sanda and Momien and in the country to the north and west" and specimens were obtained at Muangla and Momien in the Shan country over the Yunnan frontier.

The specimen is evidently a fine one as the tail measures 45·5 inches and the wing 8·8 inches compared with 36 and 8·2 inches named in the Cat. Brit. Mus. (Birds). There is a good deal more of the glossy green on the tips of the mantle feathers the back and the bars on the central tail feathers, than the description would lead one to expect.

Lieutenant Van Someran writes: "They live, in these parts, up at a height of 8,000 feet and more, and I have never come across one below that level. From what I have been told they seem to be fairly common across the frontier among the high hills on the Chinese side."

E. COMBER, F.Z.S.

BOMBAY, 12*th June*, 1905.

No XVII.—CATASTROPHE AMONGST THE YOUNG OF THE INDIAN CLIFF-SWALLOWS (*HIRUNDO FLUVICOLA.*)

On the 14th May, I visited a culvert over a small distribution canal, within a few miles of Cawnpore, under which a whole colony of *Hirundo fluvicola* (The Indian Cliff-Swallow) had nested. The parent birds were present in great numbers, and were continually visiting the nests. On wading under the culvert I found that a large proportion of the nests contained dead birds—young but fully fledged. They were in nearly every case protruding far out of the narrow entrances of the nests, and were full of a large maggot of sorts, a few however being practically feathers and bones, and sufficiently inoffensive to enable me to send you one. Smaller birds than those found dead, struggled from their nests and managed to fly off when I approached, which emphasizes the peculiarity of the occurrence. I surmised, at first, that a sudden rise in the water must have accounted for the disaster to the young birds, but against this there is the fact that there were a few of the same age alive, and that the parent birds had not deserted their nests.

ARUNDEL BEGBIE, Major,
Adjutant, Cawnpore Vol. Rifles.

Cawnpore, 4th *June*, 1905.

No. XVIII.—NEST OF THE BROWN-BACKED INDIAN ROBIN (*THAMNOBIA CAMBAIENSIS*).

In the few books I possess dealing with the birds of India, I find no notice of the habit *T. cambaiensis* (The Brown-backed Indian Robin) has of working cast snake-skins into its nest. I have found so many cases where this has been done and invariably with what seemed an attempt at pattern, that it appears to me impossible that it was mere chance. In each instance the nest has been lined with the usual horse-hair, and worked into the lining have been two narrow strips of snake-skin, in the form of a cross. These birds are so common and their nests so easily found, that there will be no difficulty in other observers noting whether this habit is one of locality or of species.

ARUNDEL BEGBIE, Major,
Adjutant, Cawnpore Vol. Rifles.

Cawnpore, 4*th June*, 1905.

No. XIX.—A BOLD TIGER.

I wonder if any of the members of Society can parallel the following instance of a tiger's audacity?

Last February I was sitting up for a tiger over a couple of live pigs. The brute came after dark, and as he was killing the second pig I fired and missed. In about a quarter of an hour the tiger was back again finishing off the pig which was not quite dead. Again I fired and missed and went home disgusted. After I had left the machàn the tiger again returned, as we found next morning, and had his meal in peace. In the evening A. sat up in the same place. The tiger returned to finish the pig, while it was still light, and met the fate which he richly deserved. He was a young male 7 ft. 5 inch in length, but even for a tiger just out of the nursery I think he showed unusual daring. The machàn was at the outskirts of the jungle, and some distance from anywhere that the tiger could lie up during the day, and there were several villages in the vicinity.

H. TYLER, I.C.S.

Bhadrachalam,
Godavari, Madras,
5th June, 1905.

No. XX.—ARROW HEADS IN A BISON.

While cutting up a bull bison which I shot in May last, two iron arrow heads were found embedded in the flesh, one in the side and the other in the chest. A few inches of shaft was also found detached from the arrow heads. The arrow heads must have been in the bison for years. There was absolutely no sign of any wound in the skin and the bull was an old one and in good condition.

One of the arrow heads is 7⅝ inches long, the other is 7¼ inches. They weigh 3 tolas and 2¼ tolas respectively. They were deeply embedded in the body of the bison and not near the surface, yet to all external appearances they did not inconvenience him. The natives of these parts shoot bison whenever they get a chance. A few months back some of them killed a solitary bull with bows and arrows. The horns had a spread of just over 40 inches.

H. TYLER, I.C.S.

BHADRACHALAM,
GODAVARI, MADRAS,
5th June 1905.

No. XXI.—BIRDS' NESTING NEAR MHOW, C.I.

I was staying for a short time in the Nerbudda Valley in March and April at a spot about 20 miles east of Mortakka Station on the R.-M. Railway, and I noticed the following facts about the birds there which may possibly be of interest.

On April 2nd I saw a small creeper that I did not know, so I shot it and it turned out to be a Spotted-Grey Creeper (*Salpornis spilonota*). I do not think it was nesting and I did not see a second bird. It was climbing up and down the trunks of the trees searching for insects and allowed me to approach quite near ; unluckily I only had No. 4 shot with me and the bird was very much spoilt in consequence. I also saw the Indian Crested Swift (*Macropteryx coronata*) on several dates and in several spots flying about, but did not succeed in finding a nest though I searched hard in several places. I never saw more than two at a time. The common Golden-backed Woodpecker (*Brachypternus aurantius*) was nesting everywhere. I took three eggs from a tree on March 24th, but in no other hole could I find eggs during the whole of my stay in the place which lasted till April 29th.

I also noticed the Yellow-fronted Pied Woodpecker (*Liopicus mahrattensis*) but did not notice the nest hole.

I found the eggs of the Painted Sand-grouse (*Pterocles fasciatus*) on March 28th. They were laid on the ground in a very slight depression which contained two or three pieces of dry grass, and were situated in a fairly open patch of jungle under cover of a small scraggy bush ; incubation had just begun I saw several other birds, generally in pairs, throughout my stay, but did not discover any more eggs.

The Southern Green Pigeon (*Crocopus chlorogaster*) was nesting. I noticed two nests, one on March 28th and the other on April 6th, both in " Temru " trees and about 15 and 8 feet from the ground respectively ; the first had two eggs and the other one, quite fresh, On April 5th I found a nest of the White-eyed Buzzard-Eagle (*Butastur teesa)* situated about 40 feet up in a tall tree ; it only contained one egg, pure white. The bird sat on the top of a neighbouring tree all the while her nest was being examined. The nest was made of sticks and quite unlined.

The Smaller White Scavenger Vulture *(Neophron ginginianus)* was nesting on almost every suitable piece of cliff ; most of the nests being fairly easy of access by the aid of a few turbans tied together. In all the nests I looked at I found two eggs, except in one case where there was only one.

The Yellow-throated Sparrow *(Gymnorhis flavicollis)* was very numerous. I only noticed one nest containing two fresh eggs of the usual type. They were in a natural hole in a tree which had been lined with feathers ; also a few straws and a piece of rag.

The Spotted Owlet *(Athene brama)* I saw on a great many occasions and took two eggs out of a hole on April 7th ; also securing one bird for identification.

The Indian Blue Rock-Pigeon *(Columba intermedia)* was nesting on the ledges in the cliffs along the river bank. Most nests had young birds covered in dirty yellow coloured down and a few had very much incubated eggs. In one nest (April 9th) I found three eggs, one being pitted all over with lumps of chalky appearance. It was a trifle smaller than the other two and I fancy had been there longer, but it was not addled as I expected it to be. The others were fresh.

I noticed two colonies of the Indian Cliff-Swallow (*Hirundo fluvicola)* on April 9th, both of which consisted of about 80 to 100 nests. The young birds appeared to have flown in nearly every nest. I secured three eggs only, pure white, one of which had a few very pale markings of brown on the larger ends.

I noticed the Common Indian Swift *(Cypselus affinis)* occupying what I supposed to be last season's nests of the Cliff-Swallow. They had been lined with a profusion of feathers as usual. I fancy they had young birds fully fledged as well.

The Wire-tailed Swallow *(Hirundo smithii)* I also saw nesting (April 15th) quite close down to the water; two nests had 3 eggs each of the usual type. One nestfull was slightly incubated. I only noticed one nest of the Indian Pipit *(Anthus rufulus)* which had three very much incubated eggs on April 9th.

I saw one nest of the Dusky Crag-Martin *(Ptyonoprogne concolor)* with young birds, and others inaccessible which I fancy also contained young.

The Indian Darter *(Plotus melanogaster)* was fairly common on the river ; also the Black-bellied Tern *(Sterna melanogaster)*, but I think it had hatched its eggs as I could not find any.

I saw one flock of seven Shovellers *(Spatula clypeata)* on April 14th and shot one which was quite good eating.

The Brahminy Duck *(Casarca rutila)* was seen in pairs, but was very wary and wild.

On May 9th I saw a group of about a dozen Sarus Cranes *(Grus antigone)* standing on a very low lying island in a fairly large tank here (Mhow); and as my punt approached I saw an Indian River-Tern *(Sterna seena)* stoop just like a hawk at the heads of the Sarus, which ducked their heads nearly to the ground each time the Tern stooped in a most ludicrous manner. I of course expected to find some Tern's eggs but did not do so, the only eggs being one half-incubated Red-wattled Plover's *(Lobivanellus goensis)* and two practically fresh—Little Ringed Plover *(Ægialitis dubia)*. I searched the shore of the main land as well but could not discover any Tern's eggs, so still remain in the dark as to the cause of the vicious attacks on the Sarus.

On May 15th in the same place I saw flying what I took to be a young *Sterna seena* so whether the Sarus had destroyed or hurt another one on the previous day I do not know.

MARTIN YOUNG, M.B.O.U.,
1ST YORK AND LANC. REGT.

MHOW, C. I., 19*th May*, 1905.

No. XXII.—A SNAKE'S NEST.

While searching for Kingfisher's nests to-day I found a big grass nest in a chamber at the end of a short passage bored in a canal bank. This I found to contain a number of snake's eggs. Two hatched out while I was looking at them, but on opening another I found the youngster quite alive, though evidently not ready to make his appearance. Believing that snakes are always welcome I am sending the whole lot off by parcel post to the Museum.

ARUNDEL BEGBIE, MAJOR.

CAWNPORE, 14*th May*, 1905.

[The snakes arrived safely and some 24 young specimens of the checkered water snake (*Tropidonotus piscator*) were alive in the box.—EDITORS.]

No. XXIII.—THE HIMALAYAN NUTCRACKER (*NUCIFRAGA HEMISPILA*).

With reference to General Osborn's "Notes on the Himalayan Nutcracker," on page 628 of Vol. XIV, and Mr Osmaston's comments thereon on page 818 of the same Volume may I be permitted to add my observations on the subject.

Before I had seen General Osborn's remarks to the effect that *N. hemispila* itself perforated the little round holes one frequently finds in the wild walnut, I had been interested in the matter and especially so, when I on one occasion watched, through my glasses, a Nutcracker busy with a walnut. It picked up the walnut every now and again and put it down, as though choosing a better place and then would give it two or three smart taps. By the way it picked it up, off the ground, I could see that the walnut must already have had a crack or hole in it, as the beak was hardly opened more than half an inch, and after carefully watching it I saw that I was right, as the cracked side turned towards me and I distinctly saw a hole in it. I could not believe that the Nutcracker had made the hole and after it went off, as it did shortly after, I went down and examined the walnut and 2 or 3 others similarly treated.

It struck me then that a rodent of some sort had had something to do with it, so I determined on finding out the truth.

Very early next morning I placed half a dozen whole walnuts in a conspicuous spot under the tree and watched, but nothing happened that day, nor the next. I removed the walnuts during the night and put them back in the morning. On the third morning I was rewarded by seeing two Nutcrackers arrive on the scene and after hopping about on the lower branches, one went down to my walnuts, while I watched very carefully. It turned over each nut and then hopped away. The other one then also came and had a look and behaved similarly, neither attempting to break the nuts.

That evening I left the nuts under the tree and came back in the morning to find two of them, with quite large holes in each and one only slightly bored. They all struck me as having the marks of a rodent's teeth and that together with the fact, that it had been done at night, seemed to me conclusive proof, that a rat or more likely a flying squirrel was the culprit. In each case the kernel had been only partially extracted and a good deal still remained. I again left the nuts there and returned to look at them later on and found 2 of them gone and the remaining cracked one considerably more chipped than when I last saw it and every vestige of the inside removed.

In my own mind I have not a doubt that the flying squirrel starts the boring and once the shell has been chipped I dare say both Nutcrackers and Woodpeckers are capable of enlarging the opening.

Any one who has tried keeping a flying squirrel (*Pteromys inornatus*) as a pet and they make delightful ones, must know the strength of that little jaw and the sharp, hard edges of those little red teeth.

C H. DONALD.

BHADARWA, KASHMIR, *8th June*, 1905

No. XXIV.—EAGLES AS BAROMETERS.

One frquently hears how one can predict bad weather by watching a flock of sheep or kites and vultures, but it has never been brought home to me as it has been in the last month. My camp is situated at an elevation of about 7,000 feet in a big deodar forest and I had on several occasions seen a pair of spotted Hawk-Eagles (*Spizætus nepalensis*) in the nullah, about a mile or more above my camp and about 1,500 feet above it, but they never seem to come down any lower. One evening I was rather surprised to hear the shrill whistle of one quite near and soon spotted one sitting on a date tree and just before sunset he was joined by his better-half. They sat there screaming for a few minutes and then one flew down, in among a lot of smaller trees with thick foliage and the other one shortly after followed, but went in lower down. Next morning we had a most terrific storm which lasted with a couple of short breaks for 5 days (from 14th to 19th May) and all this time, the eagles remained near at hand and could be heard and seen at intervals throughout the day. The 19th dawned cloudy and threatening and I thought we were in for still more rain, but about 9 a.m. I saw the eagles soaring and watched them almost out of sight. About mid-day it cleared up and I did not see the eagles again till the other day. They arrived as before in the evening and I said to myself, I wonder if their arrival portends another storm. The weather though warm was quite clear. Sure enough at night a thunderstorm came on and it simply poured. It has rained off and on for 3 days now and the eagles are still here and I can hear them occasionally. I have just got my nets ready and a nice fat pigeon for a bait, so I hope to keep them here *a bit longer this time.*

C. H. DONALD.

BHADARWA, KASHMIR, *8th June*, 1905.

No XXV.—FIRST RECORD OF THE NIDIFICATION OF THE INDIAN HOBBY (*FALCO SEVERUS*).

On the 13th May I found The Indian Hobby (*F. severus*) breeding on the banks of the Nujit-tha river in this district. The nest was in a hole in the cliff about 30 feet above the water level. I should rather say the solitary young bird was in the hole as there was no nest.

I am sending you a skin which although sufficient for identification has suffered fearfully during the long journey in without preservatives.

I have kept the young Hobby which has now developed from an exaggerated powder-puff into a very handsome little bird. He is very tame and if a success I will send you a copy of a photograph I had taken of him yesterday.

K. C. MACDONALD (D. S. P.)

PAKOKKU, UPPER BURMA, *5th June*, 1905.

[The bird sent is without doubt a specimen of *Falco severus*, and the above record is therefore of great interest.

E. COMBER,
Honorary Secretary, Bird Section,
Bombay Nat. His. Soc.]

No. XXVI.—A WOODPECKER'S DILEMMA.

During the X'mas holidays of 1904, while out shooting in Upper Burma, one of the Burmans picked up a Thit-touk (wood-tapper) at some little distance from any tree. It proved to be a Red-rumped Green Woodpecker, *Gecinus nigrigenis* (Hume). The bird was very thin and his tail feathers very sticky, due to some resinous substance. The cause of his sad plight was soon apparent, for under the right wing, affixed to the primaries, was a large cylindrical mass of gum an inch and a half long, one and a quarter in circumference and weighing ninety grains, and which the Burmans said was the gum exuded by the Gwe-bin (*Spondias mangifera*). I imagine when he had finished his examination of the tree he had proceeded to fly to another, but the loss of the use of his primaries probably resulted in his downfall. I do not know if woodpeckers are helpless on the ground ; if they are, this may account for his thin condition, as it is possible he may have spent some time there.

Thinking the incident of interest we brought the bird to camp to shew to a friend. On his return from the jungle I asked the Burman who had accompanied me, to produce the bird, which he did. He had removed the mass of gum from the feathers but had it in his hand, and shewed the position it was in when the bird was found. We placed the bird on a tree alongside the hut and he went up it in style, tapping all the way. It did not prove a land of milk and honey, so on reaching near the top he flew off to another tree without any difficulty, where he again promptly commenced operations. It was late in the evening and he was evidently very hungry, as he was most assiduous in the search for food.

G. H. EVANS, F.L.S , MAJOR.

RANGOON, 11*th June*, 1905.

No. XXVII–FOOD OF *PYTHON MOLURUS.*

On my return to camp on the afternoon of the 24th April 1905, a friend who had been up a stream fishing, informed me that the Burmans with him had captured a python measuring over nine feet. On opening the reptile they found a pheasant. My friend asked the Burmans to keep the snake, but on my return all but the head of the snake and the pheasant (which was not quite fresh) was cooked for the evening meal.

The head of the snake showed that it was that of a *Python molurus* and the pheasant was a *Gennæus Oatesi* (Grant) or *G. lineatus* (Vigors). Both varieties were not uncommon in the jungles near by.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 11*th June*, 1905.

No. XXVIII.—BREEDING OF THE BANDED KRAIT (*BUNGARUS FASCIATUS*) IN BURMA.

The following note may prove of interest. On the 17th May I received a letter from Mr. J. D. Hamilton, I. F. S., in which he mentioned that on the day previous, while digging up some elephant tusks, he came on a Krait (*Bungarus fasciatus*) with eight eggs and four young. The female had sloughed before going underground and when found was poor in condition.

During the afternoon of the 17th he kindly sent me the female with two hatchlings, also the egg shells of which there were eight in three lots—five in a cluster, two cemented together, and one single.

The 'Krait' though possessing a nice clean skin was distinctly thin. On being touched about the body she promptly flattened herself in an extraordinary manner, and on being irritated hissed, but made no attempt to strike. She shewed no concern whatever about the youngsters, however much they were molested. The snake was very sluggish.

Measurements :—

Length 3′ 11½″
Tail 4″

Unlike the mother the youngsters were particularly active. They were extremely intolerant of the sun: an exposure of a minute or two caused them to seek the shade.

With regard to their markings, they resemble that of the adult except that they are very much paler. The prune purple bands are more of a leaden hue, and the canary yellow bands a faint dirty white not at all approaching yellow. The markings, however, were so defined as to render this snake unmistakable at first sight even at a very early age.

The end of the tail in adults is, as a rule, blunted, but in both these young specimens it was more pointed.

Measurements :—

The hatchlings measured—

(1) Length 12½″—Tail 1¼″.

(2) „ 11¾″—Tail 1⅛″.

There was nothing unusual about them. The egg shells were soaked in water and when softened indentations were removed and the shells filled with water. Owing to the position of apertures of exit, only three could be measured with anything approaching to accuracy. The average measurements taken were 2·375″ × 1·5″. The eggs struck me as being of large size considering the snake measured just on 4′.

G. H. EVANS, F.L.S., MAJOR.

RANGOON, 11*th June*, 1905.

No. XXIX.—FIRE FLIES.

Can any of our members help in contributing some information on the life history of these insects ? I can find no literature on the subject and the references to the Fireflies or *Lampyridæ* in most natural history books only give the West Indian form and tell us nothing of their habits.

It is surely astonishing that so little should be known about what constituted one of the wonders of the tropical world.

The females have apparently only one segment (the last but one) of the abdomen luminous whilst the males which are considerably smaller than the females, have both the last two segments luminous, although it appeared to me that the last segment had not quite the same amount of luminosity as the one before it.

At Khandalla (Western Ghats) this month they seemed to frequent the following trees more than others :—the 'Nandruk' (*Ficus retusa*), the 'Umbar' (*Ficus glomerata*), the 'Shaitan' (*Alstonia scholaris)*, the 'Gulmohur' (*Poinciana regia*), the 'Udal' (*Albizzia stipulata*) and the 'Waola' or 'Walwar' (*Holoptelea integrifolia*) and these were the trees which flashed with a thousand lights every few seconds. At Andheri, near Bombay, Mr. Young tells me that he has noticed them swarming in the same way round the 'Bhendi' (*Thespesia populnea*) and the wild 'Mango' (*Mangifera indica*).

The females seem to be more persistent in their luminosity although it is not so bright as in the males, whilst the latter flashed every 5 seconds at the tops of the trees, the flashes sometimes being from right to left for six or seven times, then all together and then left to right.

The sympathetic telepathy which seems to exist amongst the males at this season and causes each colony frequenting the tops of one or more trees to flash at exactly the same moment every few seconds is wonderful.

It would be interesting if some member would keep a number of these insects alive for a few months and give us some details as to the eggs they lay, the time taken in hatching and the appearance of the larvæ, &c.

What is the larva of the Firefly like and has it any luminosity ?

W. S. MILLARD.

BOMBAY, 15*th June*, 1905.

No. XXX.—CURIOUS ACCIDENT TO A DRAGONFLY.

Whilst at Khandalla (Western Ghats) recently I noticed a very large dragonfly settled on the wire by the side of the road. As it did not fly away when I approached it I took hold of the wings with my finger and thumb, and although it was alive and moved, I found the reason of its not flying away was that it was impaled on the barbed wire. One of the barbs had transfixed it just where the head joins the thorax, and it was with some difficulty that I removed it. It was one of the largest kind of dragonflies with a pale blue-green thorax and abdomen striped with very dark chocolate ; the spread of the wings measured 4½ inches and the length of head and body 3 inches.

It could not have been the work of a shrike or " butcher bird," as there were none about there, and I also doubt if a shrike could catch such a swift flyer as this large dragonfly.

W. S. MILLARD.

BOMBAY, 20*th June*, 1905.

CORRESPONDENCE.

SHOOTING IN THE BOMBAY PRESIDENCY.

No. 3482 of 1905.

Revenue Department,
Bombay Castle, 29*th April*, 1905.

To A. C. LOGAN, Esq., I.C.S.

Sir,—In reply to your letter, dated the 6th April 1905, inquiring whether the new forest regulations prohibiting shooting in notified forests except under a license chargeable with a fee of Rs. 25, apply to the shooting of birds other than game, for scientific purposes, I am to say that in forests which have been notified under No. 3 (*a*) of the Rules published in Government Notification No. 5627, dated the 18th August 1903, shooting *for any purpose* is not allowable otherwise than in accordance with that Rule and the Rules following it.

I have the honour, etc.,
G. KEATINGE,
Under-Secretary to Government.

Mahableshwar, *May* 17*th*, 1905.

To
The SECRETARY,
Bombay Natural History Society.

Sir,—I think it worth while to send you the above copy of a letter from the Revenue Department, that members of the Society may know how they stand with regard to the new forest regulations. These apply to all forests of any consequence in the Presidency.

Yours faithfully,
A. C. LOGAN, I.C.S.

Revenue Department,
Bombay Castle, 18*th August* 1903.

No. 5627.—In exercise of the powers conferred by Section 25, clause (*i*), Section 31, clause (*j*), and Section 75, clause (*d*), of the Indian Forest Act, 1878, (VII of 1878), and in supersession of Government Notification No. 6254, dated the 25th July 1894, published at page 751 of Part I of the *Bombay Government Gazette* (except in regard to the Province of Sind), His Excellency the Governor in Council is pleased, with the previous sanction of the Governor-General in Council, to prescribe the following rules to regulate hunting, shooting, poisoning of water and setting of traps or snares in the Reserved and Protected forests of the Bombay Presidency excluding Sind :—

1. The following acts are absolutely prohibited in all Reserved and Protected forests :
   (*a*) the poisoning of rivers or other water, and the explosion of dynamite therein for the purpose of killing or catching fish ;
   (*b*) the setting of spring guns ;

(c) the taking, wounding or killing of big game, other than tiger, panther, wolf, hyena, wild dog, pig or bear, over water or salt-licks ;

(d) wounding or killing the females of deer, antelope or bison ;

(e) wounding or killing any game birds or hares during the close season fixed in the Appendix.

2. The setting of snares or traps is prohibited in all Reserved and Protected forests except with the written permission of the Divisional Forest Officer.

3. (a) In any Reserved or protected forests or portions of reserved or protected forests to which the local Government may, for the purpose of strict conservation or for the preservation of animals which are becoming rare, or for both of these purposes, apply these and the following rules by a notification published in the *Bombay Government Gazette,* hunting and shooting are prohibited except under a license to be obtained from the Conservator of Forests.

(b) Every license issued under clause (a) of this rule shall permit the holder only to hunt and shoot, and shall be valid for a period of one year from the date of its grant in any reserved or protected forest in the presidency to which these rules are made applicable under clause (a), subject to the condition that before it has effect in any forest division in which the licensee does not reside or exercise any jurisdiction, it must be countersigned by the Divisional Forest Officer.

(c) No such license shall entitle the holder to hunt or shoot more than two stags or bulls of each species of animal to be specified in the license, according to a list to be prepared for each Forest Division by the Conservator of Forests.

4. Licenses shall not be refused except for special reasons to be stated in writing.

5. Wounded game may be pursued into the forests of the division adjoining that for which the license is valid or into a forest closed under Rule 8.

6. A license granted under these rules shall not be transferable.

7. Every person to whom a license has been granted under these rules, and who is found hunting, shooting, snaring or trapping in any forest to which these rules apply, shall on demand by any forest, police or revenue officer, produce his license.

8. The Conservator may, on the recommendation of the Divisional Forest Officer and the Collector, declare that any particular forest or part of a forest is wholly closed for a term of years or annually for a specified season. He may also prohibit the taking, wounding or killing of any particular species of animal in any specified tract of forest, with a view to the preservation of such species, but any such order shall be subject to revision by the Commissioner. To such forests the validity of licenses granted under these rules does not extend or is modified accordingly : provided that gazetted officers whose jurisdiction extends to such forests, or persons holding licenses on which the Divisional Forest Officer has endorsed special permission to that effect may kill pig, tigers and

other dangerous or destructive animals in such forests. Such special permission shall not be given for a longer period than one month in any case.

9. If any person to whom permission under Rule 2 or a license under Rule 3 has been granted commits a breach of any provision of the Indian Forest Act, 1878 (VII of 1878), as amended by the Forest Act, 1890, (V of 1890) or of any rules made thereunder, he shall be liable to the penalty of having the permission or license, as the case may be, cancelled by the Divisional Forest Officer, in addition to any other penalty to which he may be liable under the Indian Forest Act, 1878 (VII of 1878), or otherwise. An appeal against the cancellation of the permission or the license by the Divisional Forest Officer shall lie to the Collector, and a second appeal, in case of dismissal of the appeal by the Collector, to the Commissioner, whose decision shall be final.

10. In any case where the Divisional Forest Officer or Conservator thinks it advisable, he may direct that a Forest Guard or other person shall accompany the camp of any license-holder hunting or shooting in forests, with the object of seeing that Forest rules are not infringed by camp followers.

11. The word "hunting" as used in these rules, includes tracking for the purpose of discovering the lie of wild animals, provided that any person holding a license is not prohibited from employing any number of trackers.

12. Nothing in these rules shall be taken to exempt any person from liability in respect of any offence by injury to the forest or its produce or of any other offence punishable under the Indian Forest Act, 1878 (VII of 1878), as amended by the Forest Act, 1890 (V of 1890).

13. Nothing in these rules shall be taken to cancel any privileges granted to resident wild tribes except by the express order of the Collector, or to preclude the grant of special permission by the Divisional Forest Officer or Collector to resident villagers on special occasions.

[*N.B.*--Forest in which wild tribes have been given the privilege of hunting will not generally be notified under Rule 3.]

APPENDIX.

The game birds referred to in Rule 1 (*e*) are as below, and the close season is fixed as follows :—

For		Close Section.	
Sand-grouse ...	Pterocles fasciatus ... Pteroclurus exustus ...	1st April to	30th September.
Pea-fowl ...	Pavo cristatus	Do.	do.
Jungle-fowl ...	Gallus sonerati	Do.	do.
Spur-fowl ...	Galloperdix spadicea ... Galloperdix lunulata ...	Do.	do.
Partridge ...	Francolinus vulgaris ... Francolinus pictus ... Ortygornis or Francolinus pondicerianus.	Do.	do.

For.		Close Section.	
Rain-quail	Coturnix coromandelica	1st April to 30 September.	
Bush-quail	Perdicula argoondah or argunda Perdicula asiatica. Microperdix erythrorhynchus.	Do.	do.
Bustard-quail	Turnix pugnax Turnix gondera, or taki Turnix dussumieri	Do.	do.
Bustard	Eupodotis edwardsi	Do.	do.
Lik-florican	Sypheotides or sypheotis aurita.	Do.	do.
Whistling-teal	Dendrocygna arcuata or javanica	1st June to 30th September.	
Cotton-teal	Nettopus coromandelianus..	Do.	do.
Comb-duck	Sarcidiornis melanonotus...	Do.	do.
Spot-bill-duck	Anas poecilorhyncha	Do.	do.

The close season for Hare is 1st April to 30th September.

By order of His Excellency the Right Honourable the Governor in Council,

J. W. P. MUIR-MACKENZIE,
Chief Secretary to Government.

PROCEEDINGS

OF THE MEETING HELD ON 16TH MARCH 1905.

A meeting of the members took place at the Society's rooms, on 16th March 1905, Colonel W. B. Bannerman, (I.M.S.), presiding.

NEW MEMBERS.

The election of the following new members since the last meeting of the Society was duly announced:—

Major E. Wright, I.M.S., (Mangalore) ; Mr. F. Ritchie (Bombay) ; Captain P. P. Kilkelly, I.M.S., (Bikanir) ; Mr. W. H. Chapman (Karachi) ; Mr. F. N. Gossage (Maskeliya, Ceylon) ; Colonel W. L. Chester, R.A.M.C., (Peshawar) ; Mr. Curt Haeberle (Travancore) ; Mr. A. G. Romilly, C.E., (Bezwada) ; Lieut James McPherson, I.M.S., (Bombay) ; Mr. T. W. DeWinton, C.E., (Belgaum).

CONTRIBUTIONS TO THE MUSEUM.

Mr. H. M Phipson, the Honorary Secretary, acknowledged receipt of the following contributions to the Society's Museum :—

Contribution	Description.	Contributor.
1 Long-Legged Buzzard ...	*Buteo ferox...*	Mr. H. Bulkley.
1 Snake	*Dipsas trigonata*	Mr. J. Oxley.
Pearl Oysters from Jamnagar	*Margaritifera sp*	Mr. C. A Kinkaid.
A number of Bird Skins from Persia	......	Capt. J W. Watson, I.M.S.
1 Chameleon (alive) ..	*Chamæleon calcaratus* ...	Mr. W. E. Shipp.
The following birds from Tibet :—		
2 Blood Pheasants ...	*Ithagenes cruentus* ...	Lieut. A. R. B. Shuttleworth.
1 Snow Partridge ...	*Lerwa nivicola*	Do.
1 Red-Billed Chough ...	*Graculus eremita*	Do.
1 Tibetan Snow-Cock ...	*Tetraogallus tibetanus* ...	Do.
1 White-Breasted Asiatic Dipper	*Cinclus Kashmiriensis* ...	Do.
1 Brown Dipper	*Cinclus asiaticus*	Do.
1 Antler of the Shou or Sikhim Stag from Tibet ...	*Cervus affinis*	Do.
1 Duck (Sheldrake) ...	*Tadorna cornuta*	Mr. T. J E. Thatcher.
4 Arabian Guineafowls ...	*Numida ptilorhyncha* ...	Major F. Lock.
1 Snake	*Polyodontophis subpunctatus*	Mr. L. C. H. Young.

FOSSIL ELEPHANT.

The Honorary Secretary reminded the members of the discovery made by Mr. H. F. Beale in 1903 of the Fossil remains of a remarkably large extinct species of elephant (*Elephas namadicus*), associated with bones of Hippopotamus in the banks of the Godaveri river, near Nasik. It was with the greatest reluctance that the Committee of the Society decided that owing to lack of accommodation in its own museum, and in the absence of any Government museum, it was useless to bring these interesting Fossils to Bombay.

It was, however, satisfactory to know that the remains had been carefully excavated and will now be put together in the Indian Museum, Calcutta.

ELECTION OF OFFICE BEARERS FOR 1905.

The following gentlemen were elected as office bearers for the present year:—President: H. E. Lord Lamington, G.C M.G., G.C.I.E.; Committee: Vet.-Major G. H. Evans; Mr. E. C. Stuart Baker, F.Z.S.; Mr. E. H. Aitken; Rev. F. Dreckmann, S.J.; Mr. E. Ernest Green, F.E.S.; Lieut.-Colonel K. R. Kirtikar, I.M.S.; Mr. J. D. Inverarity, B.A., LL.B.; Lieut.-Colonel H. D. Olivier, R.E., F.Z.S.; Mr. G. C. Dudgeon, F.E.S.; Mr. A. Abercrombie; Mr. G. M. Ryan, I.F.S.; Colonel W. B. Bannerman, I.M.S.; Mr. E. Comber, F.Z.S.; Mr. T. R. D. Bell, I.F.S.; Major A. Newnham, F.Z.S.; Major C. J. Nurse, F.E.S.; Mr. L. C. H. Young, B.A., F.E.S.; Mr. J. McNeill, I.C.S.; Mr. N. C. Macleod, ex-officio; Mr. H. M. Phipson, C.M.Z.S., ex-officio; Mr. W. S. Millard, ex-officio.

ACCOUNTS FOR 1904.

Mr. N. C. Macleod, the Honorary Treasurer, placed before the meeting the accounts for the year ending 31st December 1904, showing an income of Rs. 17,027-1-5, an expenditure of Rs. 16,833-5-11, and a cash balance carried forward of Rs. 3,307-8-5 The accounts were accepted, subject to the usual audit, and a vote of thanks was passed to the Honorary Treasurer.

PAPERS READ.

The following papers were then read and discussed:—(1) The Fauna and Flora of our Metallic Currency, by the Rev. E. Blatter, S.J.; (2) Notes on Small Mammals in Kashmir and adjacent districts, by Col. A. E. Ward; (3) The Goosander (Merganser castor), by A. M. Primrose; (4) On the Breeding Seasons of big Game, by Major R. G. Burton; (5) Double-headed Snakes and other Notes, by Capt. F. Wall, I.M.S., C.M.Z.S.; (6) Description of two new Snakes from Burma, by G. A. Boulenger, F.R.S., V.P.Z.S.; (7) Fishes from the Persian Gulf, the Sea of Oman and Karachi, collected by Mr. F. V. Townsend, by C. Tate Regan, B.A. Father Blatter's investigations into the animal and vegetable life found on our current coins excited much interest, and it was a relief to know that the copper coins which circulate so freely amongst the poorest, and consequently not the cleanest, classes of the community, appear to be harmless. Father Blatter's experiments tend to confirm the statements recently made that copper is an excellent germicide. He stated that the microscopic plants and animals found by him on the copper coins were in all cases devoid of life, while those on the silver coins were, in most cases animated.

EXHIBITS.

Mr. G. R. Lowndes exhibited a plant of Streptosolen Jamesonii in flower, a new introduction into Bombay, and good flowering plants of the following Orchids:—Phalænopsis schilleriana and Cattleya schroderæ.

Mr. Millard showed the following plants recently introduced into Bombay:—Clerodendron speciosum, Manettia bicolor, Begonia Presdt. Carnot, Bertolonia Van Houteana and marmorata, Pteris childii and Adiantum beesonianum.

Dr. M. D. Cama, exhibited the fruit of the Egyptian 'Doum' or Gingerbread Palm (*Hyphæne thebaica*), showing a small scent bottle manufactured from the kernel of the nut, which closely resembles the true vegetable ivory (*Phytelephas macrocarpa*).

PROCEEDINGS

OF THE MEETING HELD ON THE 6TH JULY 1905.

A meeting of the members took place at the Society's Rooms, on the 6th July 1905, the Rev. F. Dreckmann, S.J., presiding.

NEW MEMBERS.

The election of the following 49 new members, since the last meeting was duly announced:—Life Member.—Major Tyrell Ross (Chakrata). Members.—Lieut. Godfrey Pearse (Agar, Malwa); Lieut. J. E. N. Heseltine (Ranikhet, N.-W. P.); Mr. E. A. Partridge (Secunderabad); Mr. G. W. Leeson (Goalunds, Bengal); Mr. George Cook (Sinbo, Myitkyina District, Burma); Mr. J. E. S. Nisbet (Pyinmana, U. Burma); Mr. H. R. Kerr (Sinbo, Myitkyina District, Burma); Mr. C. R. Watkins (Pyinmana, U. Burma); Dr. C. E. Silvester (Kajaldhara P. O., South Sylhet, Assam); Capt. A. H. M. Forbes (Bareilly); Mr. L. C. Glascock (Bombay); Lieut. M. J. D. Young (Aurungabad, Deccan); Mr. D. Brodie (Tellicherry, Malabar); Mr. G. B. Coleman (Bombay); Mr. C. H. Cardozo (Calicut, Malabar); Mr. L. H. Savile (Bombay); Lieut. G. A. M. Praed (Ranikhet); Mr. C. W. B. Anderdon (Port Blair); Mr. F. E. Morgan (Bezwada, Kistna District); Lieut. H. H. Smith (Cawnpore); Mr. C. C. Longden (Palamcottah, Madras); Mr. H. Leslie Andrews (Guynd P. O., Nilgiris); Mr. G. Tipper (Calcutta); Mr. C. P. Fisher (Nagpur); The Mess President, 38th C. I. Horse (Goona); Mr. W. G. Molesworth (Waltair); Mr. R. G. Kilby, I.C.S., (Ranchi, C. Nagpore); Mr. J. W. N. Cumming (Quetta); Mr. G. W. Hichens (Rangoon); Capt. R. Selous (Mhow, C. I.); Mr. P. B. Gray (Poona); Mr. C. A. Mayer (Bhadarwa P. O., Jummu State); Mr. W. M. Watson (Bombay); Mr. C. Fenimore Cooper (Mergui, Lower Burma); Dr. S. Rowland (Bombay); Dr. G. F. Petrie (M.D.) (Bombay); Mr. G. W. B. Prideaux (Taunggyi, Burma); Capt. W. B. Walker, R.A. (Bombay), Lieut. N. H. L. Watts (Bhamo, Burma); Lieut. H. H. Joll, R.F.A. (Ahmednagar); Mrs. F. E. Jackson (Gauhati, Assam); Capt. L. B. Montresor, R.F.A.; (Trimulgherry); Mr. G. A. Durie (Keng Tung, S. Shan States, Burma); Lieut. G. G. Richardson (Karachi); Mr. A. W. G. Chuckerbutty, I.C.S., (Alibag); the Inspector-General of Civil Hospitals, Bengal, Calcutta; Mr. A. A. Handley (Colombo, Ceylon); and Lt.-Col. F. J. Jencken, R.A.M.C., (Deolali).

JOURNAL.

The Honorary Secretary mentioned that the next Journal was now in the press and would, he hoped, be ready for issue about the end of this month. It would contain a large number of illustrations and the commencement of the popular series, with coloured plates, on "The Common Snakes of India," by Capt. Wall, I.M.S., and "The Common Butterflies of the Plains of India," by Mr. L. C. H. Young, would, he believed. attract a large number of new members.

CONTRIBUTIONS TO THE MUSEUM.

Mr. W. S. Millard, the Honorary Secretary, acknowledged receipt of the following contributions since the last meeting :—

Contribution.	Description.	Contributor.
1 Brown Wood-Owl…………	*Byrnium indrani* … …	Mr. Chas. Gray.
1 Rufous-Bellied Hawk-Eagle.	*Lophotriorchis kienerri* …	"
1 Pale Harrier……………	*Circus macrurus* … …	"
1 Long-Legged Buzzard ……	*Buteo ferox*… … …	"
1 Crested Honey-Buzzard …	*Pernis cristatus* … …	"
1 Kestrel …………………	*Tinnunculus alaudarius* …	"
7 Snakes (alive) ……………	*Tropidonotus piscator* …	Col. W. B. Bannerman, I.M.S.
2 Snakes (alive) ……………	*Helicops schistotosus* …	"
1 Potted Owlet………………	*Athene brama* … …	Mr. C. H. Donald.
1 Kestrel …………………	*Tinunculus alaudarius* …	"
1 Fish from Lucknow ………	………	Major A. Newnham.
1 Snake …………………	*Zamenis diadema* … …	Mr. C. H. Donald.
1 Blood Pheasant……………	*Ithagenes cruentus* …	Capt H. R. Brown, I.M.S.
1 Crimson-Horned Pheasant.	*Tragopan satyra* … …	"
1 Snake from Bangkok ………	*Homalopsis buccata* …	Mr. D. P. D. Adenwalla.
1 Crimson-Horned Pheasant	*Tragopan satyra* … …	Col. R. H. Rattray.
1 Fish from Ootacamund …	*Barbus roseipennis* …	Capt. C. F. G. Lang.
2 Tufted Pochards …………	*Nyroca fuligula* … …	Mr. R. H. Heath, C.E.
1 Gadwall …………………	*Chaulelasmus streperus* ..	"
1 Blyth's Wreathed Hornbill.	*Rhytioceros subruficollis.*	Mr. C. W. Allen.
1 Daurian Myna ……………	*Agropsar sturninus* …	"
2 Snakes …………………	*Naia tripudians (banded variety).*	Col. R. H. Rattray.
3 Bats………………………	………	"
1 Skin of the Hispid Hare…	*Lepus hispidus* … …	Mr. J. C. H. Mitchell.
2 Spot-Bill Ducks …………	*Anas poecilorhyncha* …	Mr. R. H. Heath.
1 Spotted Sandgrouse ………	*Pteroclurus senegallus* …	"
6 Fresh Water Fishes from Kolaba.	*Ambassis baculis ; Barbus kolus ; Barbus pinnauratus ; Rosbora daniconius; Gobius guiris ; and Ophiocephalus gachua.*	Mr. W.A. Wallinger, I.F.S
1 Afghan Jerboa……………	*Alactaga indica*…………	Lt. W. K. Thyne, R.I.M.
4 Moths from Bangkok……	*Trabala vishnu* …………	Mr. E. W. Trotter.
Some Leaf Insects from Ceylon.	*Phyllium scythe*…………	Mr. R. J. Tata.
1 Snake from Persian Gulf.	*Dryophis sp :* …………	Major Knox.
1 Snake from Persian Gulf.	*Psammophis sp :* …………	"
1 Lizard from Persian Gulf.	*Varanu griseus*…………	"

Contribution.	Description.	Contributor.
21 Young Snakes (alive)...	*Tropidonotus piscator*	Major A. Begbie.
1 Desert Lark.................	*Alaemon desertorum*	Mr. J. W. N. Cumming.
1 Indian Monitor, (juv).	*Varanus bengalensis*	Mr. C. W. M Hudson, I.C.S.
1 Himalayan Ibex Head (Malformed).	*Copra sibirica*.................	Col. St G. C. Gore, R E., C.S.I.
1 Blewitt's Bush-Quail	*Microperdix blewitti*	Mr. P. Roscal Allen.
2 Lady Amherst's Pheasants.	*Chrysolophus amherstiae*...	Lt. W. W. Van Someren, D.S.O.
*1 Singapore Cockatoo (alive).	......	Mr. F. H. Cooke.
2 Snakes	*Zamenis mucosus swallowing Psammophis condonarus*	Mr. S. Lightfoot.
1 Indian Hobby.............	*Falco severus*	Mr. K. C. Macdonald, D.S.P.
1 Indian Monitor (juv)......	*Varanus bengalensis*........	Mr. M. C. Joshi.
1 Sea Snake......	*Distira robusta*...............	Mr. C. J. Michael.
1 Large-Crested Tern.........	*Sterna bergii*..............	Major P. Z. Cox, F.Z.S.
1 Smaller-Crested Tern and 3 eggs.	*Sterna media*	,,
1 White-Cheeked Tern and 3 eggs.	*Sterna albigena*..............	,,
1 Panayan Tern and 4 eggs.	*Sterna anaestheta*	,,

* Forwarded to the Victoria Gardens.

Minor Contributions from—Mr. W. Sparke ; Mr. F. Gleadow ; Mr. F. G. Arnould ; Capt. C. H. Turner ; Mr. Wagstaff ; Mrs. A. L. Alexander ; Miss F. Bayley ; Mr. C. W. M. Hudson, I.C.S.; and Col. W. Capper.

CONTRIBUTIONS TO THE LIBRARY.

Fauna of British India, "Butterflies," Vol. I., by Col. C. T. Bingham, from the author. "Spolia Zeylanica," from the Colombo Museum. Bulletin of the Agricultural and Horticultural Society of Western India, Nos. 2 and 3. The Transactions of the Entomological Society of the London, 1904, in exchange. "On the Elephant Mosquito," by E. E. Green, from the author.

Catalogue of Moths, Vols. IV and V. (Text and Plates), Guide to Bird Gallery, Guide to Shell and Starfish Galleries, Guide to Coral Gallery, Guide to Fossil Mammals and Birds, Handbook for Collectors and Blood-sucking Flies and how to collect them, from the British Museum, South Kensington. In exchange.

Catalogue of the Indian Decapod Crustacea, in the collection of the Indian Museum by Major A. Alcock, I.M.S., F.R.S., C.I.E., and an account of the deep-sea Holothurisidea collected by the R.I.M. Survey ship "Investigator," by R. Koehler and C. Vaney. Presented by the Trustees of the Indian Museum.

PAPERS READ.

The following papers were then read and discussed : (1) The Distribution of the Various Varieties of Cobras in India, by Lt.-Col. W. B. Bannerman, I.M.S.; (2) The Common Striped Palm Squirrel, by R. C. Wroughton, F.Z.S.; (3) Birds'

Nesting in the Murree Hills, by Lt.-Col. R. H. Rattray; (4) Rough Notes on Six Common Hill Orchids, by Major M. B. Roberts; (5) Tigers hamstringing their Prey before killing it, by C. W. Allan, B.F.S.; (6) Food of Predaceous Flies, by F. Gleadow, F.R.M.S., I.F.S.; (7) Descriptions of New Species of Moths from India and Burma, by G. C. Dudgeon, F.E.S.; (8) Strange Mortality amongst Termites on Tea Bushes, by E. E. Green, F.E.S.; (9) Occurrence of Lady Amherst's Pheasant in Burma, by E. Comber, F.Z.S.; (10) First Record of the Nidification of the Indian Hobby (*Falco severus*), by K. C. Macdonald, D.S.P.; (11) A Bandicoot in Sind, by E. H. Aitken; (12) Eagles as Barometers, by C. H. Donald; (13) A Congregation of Harriers, by C. H. Donald.

EXHIBITS.

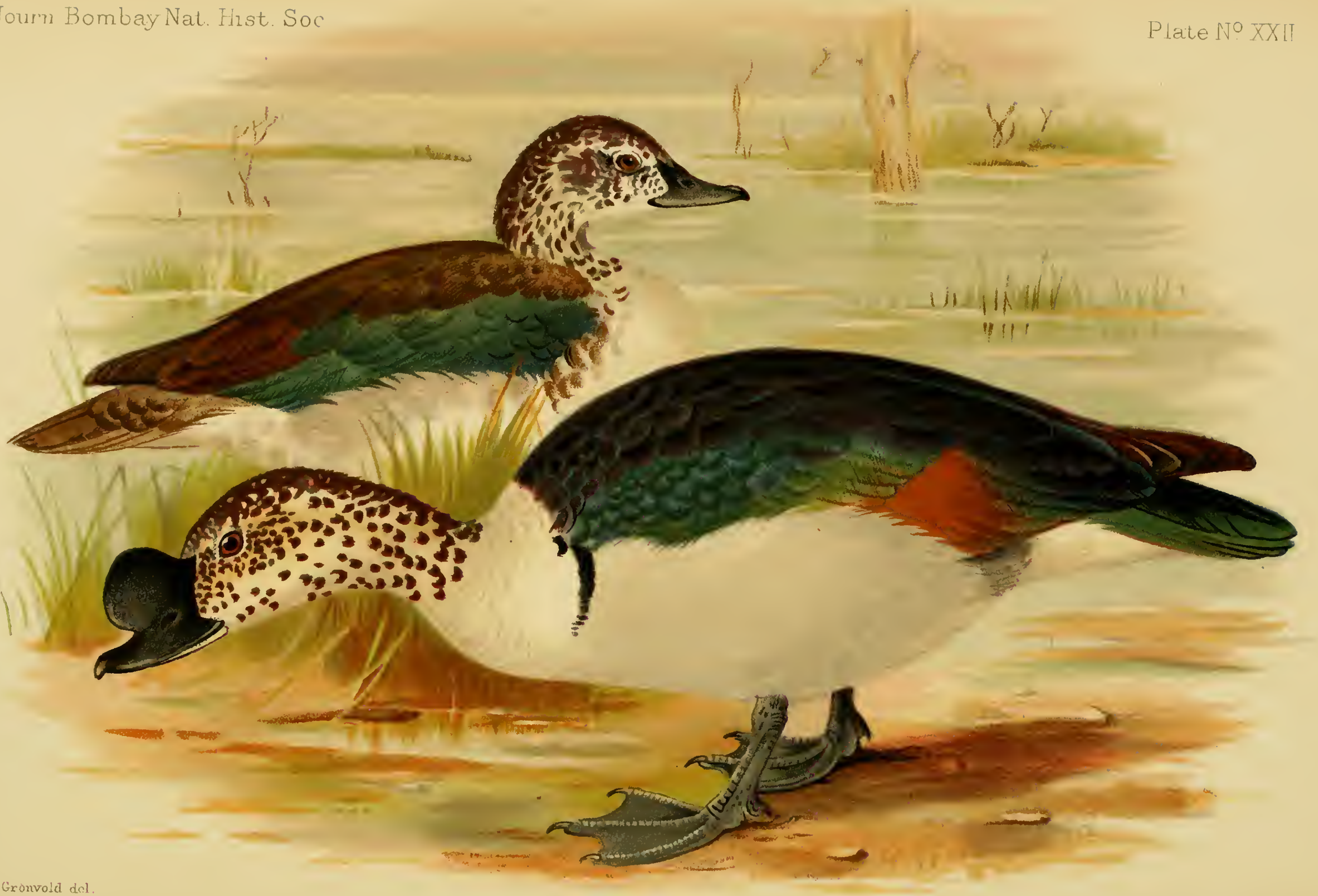
Colonel Bannerman, I.M.S, exhibited the different varieties of Cobras (alive) and a number of spirit specimens. He mentioned that out of more than 1,000 cobras received by them at Parel only 8 were from the Bombay Presidency, and these had been purchased. This did not speak well for science on this side of India, and it was to be hoped now that attention had been drawn to the subject that members of the Natural History Society and others would send in specimens.

A curiously malformed head of the Himalayan Ibex (*Capro sibirica*) was exhibited and Colonel St. G. C. Gore, R. E., in referring to it, drew attention to the fact that it must have died from starvation as the malformed horn completely closed the jaws and would have prevented it from feeding.

Mr. Narotamdass Morarjee Goculdass exhibited a beautiful flowering lily (*L. melpomene*), which was much admired.

In proposing a vote of thanks to Colonel Bannerman and the other authors of papers read, the Rev. F. Dreckmann said that he hoped that the reproach which was lying on this Presidency would be speedily removed and that cobras from this side of India, as well as elsewhere, would be forwarded to Colonel Bannerman at Parel.

Plate Nº XXII



H Grönvold del.

Mintern Bros. Chromo-lith London.

THE NUKHTA OR COMB DUCK.

Sarcidiornis melanonota.

JOURNAL
OF THE
BOMBAY
Natural History Society.

Vol. XVI. BOMBAY. No. 4.

A POPULAR TREATISE ON THE COMMON INDIAN SNAKES.

Illustrated by Coloured Plates and Diagrams.

By Captain F. Wall, I.M.S., C.M.Z.S.

Part I.—With Plate I and Diagrams I, II and III.

This and the succeeding articles with their accompanying plates and diagrams are designed to acquaint our readers with the common snakes of India. There is no book on the subject written in popular language, and the few that show coloured plates are very expensive, while accuracy of detail seems to have been largely sacrificed for pictorial effect.

If our object can be achieved, and normal specimens easily recognized, we hope that many lovers of natural history may be encouraged to make and record observations on the habits of these creatures, for the letterpress will, I fear, only too soon reveal the dearth of knowledge in this direction even with regard to the commonest kinds.

The descriptive parts of the best works are couched in terse and scientific language, and though excellently written by experts in museums the authors have had no facilities for observing the habits of creatures they only see in spirit on museum shelves. We must, therefore, rely upon those who actually come into contact with living snakes to supply such information.

It will be my aim to word these articles in unscientific language, especially with reference to the important matter of identification. Here, if technical terms must be used, they will be explained by outline drawings. The final description cannot be so treated, and being incorporated for the sake of completeness, is intended for those conversant with the subject.

I shall not attempt to treat the subject exhaustively, as it seems to me a more useful purpose will be served by dealing with the commonest and most widely distributed species. Where a resemblance exists between two or more species, especially where one is poisonous and the others harmless, they will be shown together and an attempt will be made to frame easy rules whereby they may be distinguished, but here I must repeat what I have said in previous papers in this Journal, *viz.*, that of all fallacious methods of identifying snakes, the usual one adopted with relation to colour and markings is the most unreliable. Attention must be given to the arrangement of the scales and shields.* We must again appeal to our readers to render every assistance by procuring living specimens without which the true colouring cannot be shown by our artists.

The plates will show only a few inches in the middle of the body, in preference to a full-length drawing which would necessarily be on too small a scale in many cases to show the detail required for identification. Our first plate represents the common green pit viper (*Lachesis gramineus*), and the common green whip snake (*Dryophis mycterizans*).

Before describing our first snake I think it advisable to make a few remarks on vipers in general so as to indicate their position in the snake world, and the relationship of this to other vipers.

The word viper is derived from the Latin *vivus* alive and *pario* I bring forth, in reference to a method of birth unusual among ophidians, but not peculiar to this family.† Among our Indian representatives the true fresh water snakes (*Homalopsidæ*) and the sea snakes (*Hydrophiidæ*) also produce young.

It is probably this viviparous habit which has led to the belief still hard to dispel from credulous minds, that vipers protect their young by swallowing them. A pregnant mother approaching parturition is killed, and living young found within her, or observed to escape from her: the erroneous conclusion is drawn that these must have been swallowed, especially as it is popularly understood that snakes produce eggs.

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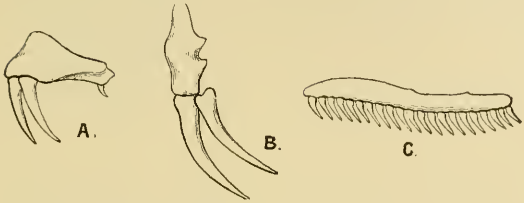
* Every scale of sufficient size and constancy to deserve a special name is called a *shield* technically. The word *scale* is used technically to designate small and numerous forms such as those on the back.

† The rule that vipers are viviparous is not absolute. Two African species are known to be oviparous, *viz.*, *Atractaspis irregularis* and *Causus rhombeatus*, and one South American species, *viz.*, *Lachesis mutus*. It is quite possible, too, that some Indian representatives may evince a similar habit. (Since writing the above Mr. G. A. Miller has conclusively shown that *Lachesis monticola* is oviparous in habit.—*Vide* B. N. H. S. Journal, Vol. XV, p. 729.)



A.—Maxillary of *Naia tripudians* supporting solid tooth behind fangs.

B.—Maxillary of *Vipera russellii.*

C.—Maxillary of *Coluber radiatus.*

I am not infrequently asked what is a viperine and what a colubrine snake.* The distinction lies in the shape of the maxillaries, or upper jaw bones, which in all vipers are shorter in their antero-posterior than in their vertical direction. They thus resemble short stumpy pillars set up on end in the front of the mouth on each side (see fig. B) and form part of an arrangement, governed by a simple and beautifully devised muscular apparatus which permits the maxillary and fangs as a whole to be swept forwards and backwards. The fangs of vipers which like all fangs are situated in the maxillary only, are long and pierced by a minute canal which opens anteriorly near the tip. They are curved backwards, and when the jaws are closed, the maxillaries are inclined backwards, so that the fangs lie along the palate with their points sloping upwards. In the act of striking, the jaws are widely opened, and the maxillary is swung so far forwards that the fang or fangs (for they may be multiple) fixed in it may assume a forward direction. It will easily be seen how this range of movement augments the facility with which a penetrating wound is inflicted. In addition to these peculiarities in shape and mobility, a third point may be mentioned, *viz.*, that the viperine maxillary supports fangs only, and never any ordinary solid teeth. In all colubrine snakes, *i.e.*, all snakes non-viperine, the maxillary is firstly so shaped that the antero-posterior axis (or in the blind snakes *Typhlopidæ* the transverse axis) is much longer than the vertical (see figs. A and C), secondly it is immovable, and thirdly in the poisonous colubrine snakes (cobras, kraits, etc.) its armament is supplemented with one or more solid teeth.†

All vipers are poisonous, but not to an equal degree, for though some inflict a wound which is usually fatal, others do not cause death, and in some the effects of the poison are trifling.

There are at least 105 kinds of vipers known to science which are grouped together into one large family (*Viperidæ*). This is divided into two sub-families distinguished by the presence or absence of a pit in the side of the face between the eye and nostril, a trait in the physiognomy too conspicuous to overlook, though the casual observer may mistake it for the nostril, which latter should be sought for as a minute orifice on the side of the snout in advance of the pit. This opening is called the loreal pit owing to its being located in that region which in birds and other creatures is called the lore. It leads into a blind rounded chamber in the maxillary, and is lined with the same covering which overlies the scales on the face, so that when the creature sheds its skin, a perfect cast of the chamber is thrown off with the slough. Its function has not yet been determined.

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* Gray in his work Snakes of the British Museum, 1849, divided snakes into two suborders, viperine and colubrine, and these terms have remained in use.

† Except in the two genera *Callophis* and *Doliophis.*

Vipers having no such pit are classed under a separate sub-family, *Viperinæ*, and may be called pitless vipers in contradistinction to the *Crotalinæ* or pit vipers. This latter sub-family derives its name from the Greek word "*krotalon*," a rattle, its prototypes being the world-renowned rattlesnakes of the American continent. It comprises four genera, two of which are peculiar to America, and two, *Lachesis* and *Ancistrodon*, though not peculiar to, are well represented in India and its dependencies. *Lachesis*, to which our first snake belongs, is separated from *Ancistrodon* by having on the head mainly small shields similar to those on the creature's back.

THE COMMON GREEN PIT VIPER.

Lachesis gramineus.[1]

The genus *Lachesis* is a large one comprising forty-one known species which inhabit Asia and America.—Of these eighteen are peculiar to Asia, and ten come within our Indian limits.

Nomenclature (*a*) *Scientific.* Lachesis, from whom the generic name originated, was one of the Parcæ or Fates of Grecian mythology who with Clotho and Atropos controlled man's destiny. Our readers who are conversant with ophiology may be more familiar with the genus under its older title *Trimeresurus*.*

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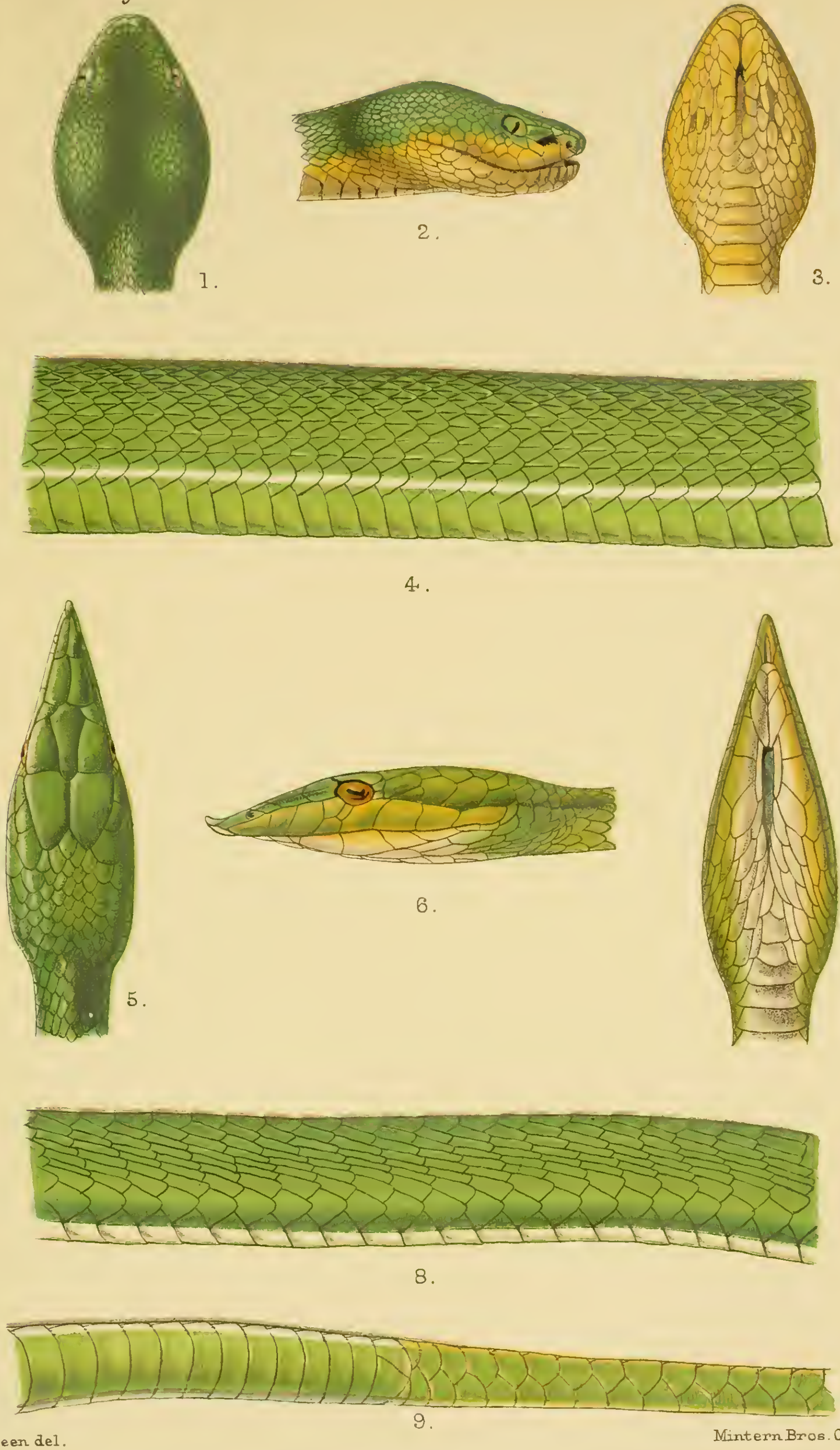
* This name was introduced by Lacépède. He divided land snakes into three groups, according to the arrangement of the shields beneath the tail. In some these pass uninterruptedly from side to side exactly like those on the belly. In the majority of snakes, however, they are divided in the median line by oblique alternately directed sutures so as to form a zigzag line. Rarely it happens that some of the first and some of the last shields are divided, whilst some intervening ones are undivided. To this category he applied the name *trimeresurus* from the Greek words "*treis*" three, "*meros*" part, "*oura*" tail. The name once created was perpetuated, and as time went on, and snakes were classified differently, it became applied to this genus to which it is quite inappropriate, for the shields beneath the tail are divided throughout.



J. Green del. Mintern Bros. Chromo.

TWO TREE-SNAKES.

Lachesis gramineus (poisonous) N^{os}. 1 to 4.
Dryophis mycterizans (harmless) N^{os}. 5 to 9.

Gramineus, the specific name, is derived from the Latin "*gramen*" grass, in reference to its verdant coloration.

(*b*) *English.*—The common green pit viper is, I think, the best English name for it, but bamboo snake as used in Hongkong, and I believe in Assam, seems to me very appropriate.

(*c*) *Vernacular.*—* Russell makes mention of it under the name of "bodroo pam" which natives at Vizagapatam on the East Coast of India call it. The Burmese call it "mywé sein," meaning "green snake." Mr. S. S. Flower† says it is called in Siam "ngu kheeyo," which means "green snake" and Cantor says the Malays know it as "ular daun" "leaf snake."

Dimensions.—The largest specimen is, I believe, that recorded by Veterinary Captain (now Veterinary Major) Evans and myself from Burma. It taped three feet eight inches but was quite a phenomenal specimen. Average adults vary from about two to two and-a-half feet.

Bodily configuration.—The head is flattened, and appears unduly broad behind owing to the pronounced constriction of the neck.[2] The body is stouter than in most snakes, and the tail tapering rather rapidly is short and prehensile, measuring usually about one-sixth to one-fifth of the total length. The females, as is the rule with snakes, have shorter tails and fewer shields beneath (sub-caudals).

Colour.—This is usually a dull uniform verdant green above, rather darker on the head and in old specimens. Underparts glossy white, yellow or green. Upper lips, chin, and throat enamel white, or bluish, or buff, or yellow, or greenish, these colours variously distributed in different individuals, and in different parts of the same individual. A well-defined white or bluish or yellow narrow line runs along flanks from neck ending some distance along the tail. Tail yellowish or reddish often mottled with darker hues. The eye, which is lateral and has a very slight inclination forwards, exhibits a beautifully golden iris, in the centre of which is a black vertical pupil. Sometimes there are black or blackish markings on the back with a tendency to arrange themselves into indistinct crossbars. Sometimes the prevailing colour is yellowish or olivaceous rather than green. Mr. W. S. Millard in a letter to me mentions one such specimen from the vicinity of Darjeeling. "It was warm, yellowish, olive-brown above, and bright yellow beneath."

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* Ind. Ser. Vol. 1, p. 13, plate IX.

† Proc. Zool. Soc., Lond., May 16th, 1899, page 695.

It was sent to the British Museum, and identified by Mr. Boulenger as a colour variety of this species.[3] Sometimes the flank line is inconspicuous or even wanting. The green colour is imparted to the spirit in which specimens are preserved, and accounts probably for the change of colour which they undergo in this medium, approaching blue rather than green.

Identification.—This is easy. Any grass green snake with a vertical pupil like the domestic cat's must be either *Lachesis gramineus* or *L. purpureomaculatus* or *L. macrolepis.* The loreal pit will confirm this diagnosis. To distinguish between these snakes count the rows of scales over the back in the posterior part of the body. In *gramineus* they number fifteen normally, sometimes seventeen ; in *purpureomaculatus* they are nineteen normally ; and in *macrolepis* eleven or ten. (To do this, turn the creature on to its back, and seek for the vent, a transverse aperture in the hinder parts. This marks the junction of the body and tail. Count at a spot two heads lengths in front of this.)[4]

Haunts.—It usually frequents low vegetation, selecting a hedgerow or tangle of bush, but shows a marked preference for bamboo in localities where this flourishes. Sometimes it is encountered in grass, and Theobald mentions having found one in the caves near Moulmein in Lower Burma, and another on limestone rocks on the ground. Mr. S. S. Flower * records one coming into a house, and Captain Evans and I have known a similar intrusion in Burma where one was killed found lying, along a beam in a native hut having swallowed a small rat. Günther † mentions it hanging from branches of trees, but I think it is more usually to be seen reclining among branches close to the ground (say nearer four than eight feet). Mr. Hampton tells me that in captivity they spend most of their time on the branches provided for them, and seldom descend except at night. During the winter a few retired under blankets, but the majority remained huddled together on branches. Whether in grass or in bush its colour harmonises so perfectly with its environment that it is usually not discovered until seen to move.

Disposition.—Günther ‡ speaking of the genus alludes to their sluggish habits, and says they sometimes make no attempt to move out of one's way. Later the same author says : "When roused these snakes are extremely fierce, striking at everything within their reach." Mr. Gerhardt in a letter to me writes : "They are very sluggish, and allow

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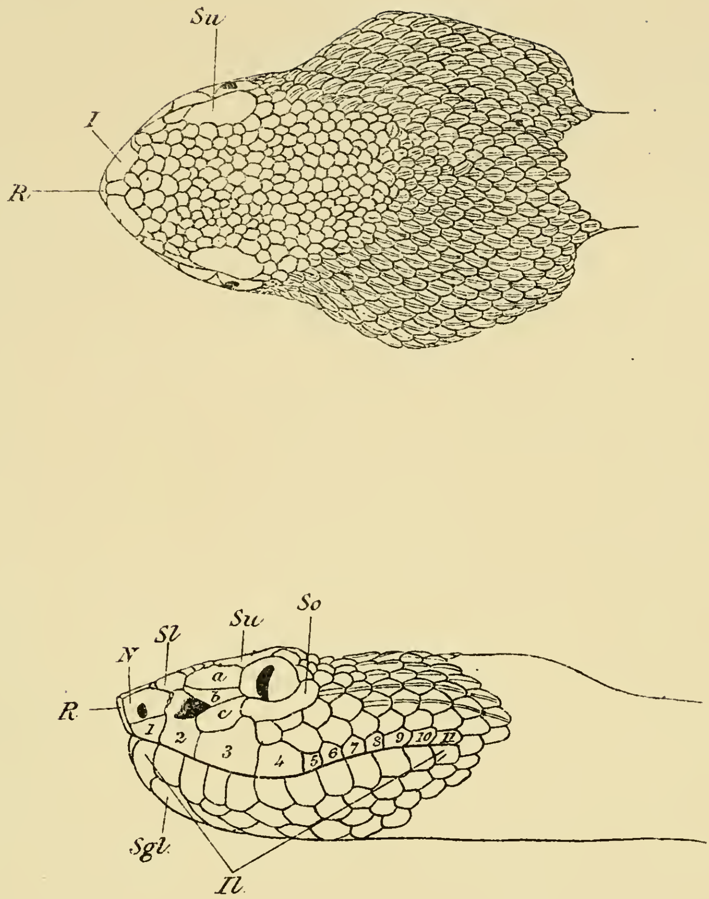
* Proc., Zool. Soc , Lond., May 16th, 1899, page 696. † Rept., Brit. India, p. 386 (1863-64)

‡ „ „ „ p. 384.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i.	*Internasal*	*Sgl.*	*Sublingual*
Il.	*Infralabials*	*So.*	*Subocular*
N.	*Nasal*	*Su.*	*Supraocular*
R.	*Rostral*	*a.b.c.*	*Praeoculars*
Sl.	*Supraloreal*	*1-11*	*Supralabials*

LACHESIS GRAMINEUS.

THE COMMON GREEN PIT-VIPER.

× 1½

A. P. CORTEZ & CO. LITH. BOMB.

one to take them off the bush with a stick." Russell * says of one brought in to him "it looked fresh, and lively, and was very alert, hissed and snapped at everything opposed to it." Mr. Hampton says in a letter: "I consider it to be a very sluggish, harmless poisonous snake." He continues: "When a match is struck in front of the cage at night, or a lamp is suddenly brought in front of the cage, they will strike at it. They seem to be very hardy in captivity; some presented to the Zoological Society in 1886 by Mr. Bligh of the P. W. D., Burma, are still alive and well, I hear from two sources." Stoliczka says, speaking of specimens he had encountered near Moulmein: "All were very sluggish and did not make the slightest attempt to escape when approached, and even allowed themselves to be removed from the top of the plant. Neither did they offer to bite unless when pressed to the ground with a stick; but when thoroughly aroused they turned round and bit furiously."

Food.—Its diet consists of small vertebrates, but some partiality is shown towards mammals.

Günther † observes that it feeds on small birds and frogs. Mr. S. S. Flower ‡ mentions lizards, and Cantor says it preys on small birds and tree frogs, but occasionally descends to the ground in search of frogs and toads. Mr. Gerhardt writes to me he has only known them eat musk rats (*i.e., Crociduræ*). Major Evans, A.V.D., in a letter to me says he has known them eat a musk rat or shrew, a field mouse, a field rat and a lizard (*Calotes mystaceus*). Mr. Hampton writes to me: "Rats are its principal food in captivity," but he has known them eat a tree shrew (*Tupaia*), and on one occasion two moles. When hard up, he says, they eat frogs, and he has known a snake (*Lycodon fasciatus*) to have been eaten on two occasions. I have records of a musk rat being ingested once, also a rat, and I saw a specimen in the Hongkong Museum in the act of swallowing a small bird. Mr. Millard writes to me: "We find them feed readily in confinement on small rats, mice, birds, and lizards."

Breeding.—The only information I can get in this direction is from Mr. Hampton, who says they produce from seven to twelve young at a time. I have examined a specimen which contained 11 eggs, 6 in one ovary and 5 in the other. They were immature, showing no trace of embryos, and were closely packed so that their longest diameters lay vertically.[5]

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* Ind. Serp., Vol. 1, p. 13.

† Rept., Brit. India, p. 386.

‡ Proc. Zool. Soc., Lond., Pt. III, 1899, p. 696.

Striking.—When provoked to strike this viper attaches itself firmly by wrapping its tail and hinder body round a branch, and then with retracted head, the forebody freed, and thrown into a broad S. it thrusts vehemently forward with open jaws as far as the straightening of the body permits. Mr. Millard in a letter says : " They always retain a hold of their prey after once striking it." Mr. Hampton writes to me that in captivity they wait until their prey passes beneath them, then strike and hold it in the air until dead, or haul it on to the branch and then swallow it.

Mr. Millard in another letter writes : " I cannot find any one who has ever heard them hiss." Possibly the hiss is too subdued to attract much attention, for Rüssell in a passage already quoted mentions this snake hissing, and Günther speaking of the genus says " that they vibrate the tail, and utter a faint hissing sound."

Poison.—Accounts of the virulence of its poison all agree in ascribing to it a decidedly feeble action on man. Günther * speaking of the genus says : " Numerous cases are on record which show that the symptoms indicating a general effect on the system were of short duration extending only over the space of from two to forty-eight hours, and confined to vomiting, nausea and fever. After the pain and swelling of the bitten member or spot have subsided, the vicinity round the wound becomes discolored, mortifies, and is finally thrown off as a black, circular slough, after which health is speedily restored. The bite of larger specimens from 2 to 3 feet long is more dangerous and has occasionally proved fatal." Nicholson† says of the genus " their bite produces local pain and swelling, but no toxic symptoms."

Russell ‡ says the peasants who brought it in, affirmed that its power of killing extended only to the smaller animals, not to dogs or sheep ; and that to man its bite caused various disorders, but never death. He substantiates this by experiment : a chicken died, but a dog and a pig, though very ill, did not succumb. Mr. Millard told me that the Revd. F. Dreckman, S.J., who is well acquainted with these snakes, was bitten in the finger by one, and suffered very little pain and inconvenience. Major Evans, A.V.D., gives me three instances in his knowledge where men were bitten, and in all cases they recovered. The Burmans, too, assured him, when he narrowly escaped being bitten by one in jungle, that its bite would not have proved fatal. Mr. Hampton has also known cases of men bitten by this snake, but never a death in consequence. On making enquiries at the Civil Hospital in Hongkong in 1901 I ascertained that no case of snake bite had ever been treated in that institution, and as this snake is quite one of the commonest in that locality, this circumstance adds weight to the accuracy of the above remarks.

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* Rept., Brit. Ind., p. 384.

† Ind. Snakes, pp. 144-5.

‡ Ind. Serp., Vol. 1, p. 14.

Distribution.—(*a*) (Geographical).—Its range of distribution is a large one, extending from the Western Ghats of India through Burma, the Malay Peninsula (including Siam and Cochin China), the whole Malayan Archipelago to Southern China and Formosa on the one hand, and from the Himalayas through the peninsula of India as far South as the Cauvery river. The most southern record I can find is the Wynad (Madmalley). It is not recorded from Ceylon, and Mr. Ferguson, who has collected reptiles for fifteen years in Travancore, writes to me that it is unknown in that territory. I can find no record of its occurrence in the Nilgiris, Anamallay, and Palneys[6].

(*b*) (Local).—In India it is, I believe, not found in the actual plains, except in the Sunderbunds, but always at some altitude about 1,500 feet and upwards, and is generally regarded as a hill snake in the Peninsula. In Burma and Further East it is met with frequently at or near sea level, as well as being found in upland regions.

(*c*) (Numerical).—Though it cannot be considered a common snake in the sense that the dhâman (*Zamenis mucosus*) and paddy-field snake (*Tropidonotus piscator*) are, it is by no means uncommon in many localities. From Mr. Millard and Mr. Gerhardt I gather it is plentiful on the Western Ghats near Bombay (Karli and Khandalla), and Mr. Millard remarks that though common thereabouts up to the end of October, they are not seen after the middle of November. Anderson* says: "It appears to be a common snake in the tropical valleys below Darjeeling, where it is usually found at an elevation of 2,000 feet." Stoliczka says it appears common in the Khasi Hills and Assam, and also near Moulmein in Lower Burmah. He mentions he never observed it in the interior of the North-West Himalayas. Mr. Hampton, writing from Burma, says he has had scores of them. Out of 694 snakes collected by Captain Evans and myself from all parts of Burma in 1899-1900, 18 were of this species. Mr. Flower describes it as being fairly numerous about Bangkok, and both he and Stoliczka record it as the commonest *Lachesis* in Penang and the Province Wellesley, but say it is rare at Singapore. I found it a common snake about Hongkong, but it appears to be a rare snake as far north as the Yangtse Valley in China.

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* Proc. Zool. Soc., Lond., 1871, p. 194.

Description.—Rostral in contact with 5-7 shields, the sutures made with the nasals being three to four times those made with the first supralabials. *Internasals* one pair, sometimes in contact behind the rostral, sometimes separated in front by one or two scales. *Supraocular* a single well developed shield each side. *Nasal* normally undivided; frequently more or less confluent with the first supralabial; frequently more or less separated from second supralabial by one or more minute intercalary scales. *Supraloreals* usually single, and not in contact with the internasals. *Præoculars* three. The two lowest, divergent forwards, bound the loreal pit. *Suboculars* crescentic, may or may not touch the third supralabial, one or two rows of scales between it and fourth supralabial. *Temporal* smooth or shaped like the carapace of a tortoise, never truly keeled. *Supralabials* nine to twelve; the second with a groove in the upper half sloping into the loreal pit; none touch the eye. *Sublinguals* one pair. *Infralabials.*—The first form a suture behind the mental; first, second, and usually the third also, touch the sublinguals. *Scales* two heads lengths behind the head 21 (rarely 20—19); midbody 21 (rarely 23 or 19); two heads lengths in front of vent 15 (rarely 17 or 13). Apices very acuminate. Last row much largest. Keels narrow towards tips of scales, and present in all the rows, except the last, for a variable extent anteriorly. *Supracaudals* in even numbers of rows, keels faint till lost in the sixes. *Ventrals* 145—175 (Boulenger). *Anal* entire. *Subcaudals* 53—75 (Boulenger) divided.*

THE COMMON GREEN WHIPSNAKE.

Dryophis mycterizans.

Nearly all the snakes that enjoy an arboreal existence are conspicuous for their beauty. Their graceful bearing, shapely proportions, and the richness and combination of the colours that adorn them combine to amply justify their being ranked among the most beautiful of living creatures.

The common green whipsnake, which may be taken as the type of the genus, forms no exception to this rule. In colour and markings it very closely resembles the green pit viper, and is on this account shown with it in the first plate; however in most other characteristics the two are widely different, and if proper attention is directed to the arrangement of the shields and scales no confusion of the two is likely to be made.

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* Stoliczka in J. A. S., Ben. Vol. XXXIX, (3), 1870, p. 217, mentions a specimen with the 5th and 6th entire, and another in same paper, p. 221, with 3rd and 7th entire.

Nomenclature (a) Scientific.—The generic name is derived from the Greek "*drus*," a bush, and "*ophis*" snake. The specific designation is from the Greek "*mucterizo*," I turn up the nose, and refers to the character of its snout.

(*b*) *English.*—The common green whipsnake is the name it is familiarly known by, and is very appropriate.

(*c*) *Vernacular.*—In India it is known by the Tamils as "kănkūttee pamboo," meaning "eye-poking snake"; and "pachai pamboo" or "green snake."

On the Malabar Coast it is called "păchola pāmbu," which means cocoanut leaf snake. In Telegu it is called "pasarika pāmoo," meaning green snake, "botla pasarika," spotted green snake, and "pastiletti" (Russell). In Ceylon the Singhalese call it "ehetula" or "esgulla" which Mr. E. E. Green writes me means eyeplucker, *i.e.*, "ehe," plural "es" = eye, and "ugulanawa" = to pluck out. In Burma it is known as "mywé sein," *i.e.*, green snake, and "mywé sein myé she," long-tailed green snake. Mr. Flower says it is called "nga kee-o pah-king-kop" by the Siamese. Both Burmese and Siamese apply these names equally to *Dryophis prasinus*, and the Burmese also to *Coluber prasinus* and *Lachesis graminius.*

Dimensions.—My largest specimen taped 5 feet 7½ inches, but a more usual length for adults is between 4 and 5 feet^7. Günther and Theobald say it grows to more than 6 feet. Günther * says it appears to remain smaller in Ceylon, and mentions 40 inches as the largest measurement known to him from that island. The young when born, according to a note by Mr. Ferguson † at Travancore, taped 17 inches. Mr. E. E. Green, ‡ however, speaking of a Ceylon specimen, said that its young were 350 mm. (*i.e.*, 13⅞") at birth. These measurements seem to substantiate Günther's observation.

Bodily configuration.—The head, which is long and narrow, ends in a fleshy pointed snout, and a prominent elevated ridge extends from this to the eyebrow. The eye, which is set laterally, has also a decided inclination forwards. The iris is a beautiful bright golden colour throughout. The pupil is horizontal and elongate in outline with a slight constriction near its middle. This horizontal outline endows this snake with a very remarkable range of vision. The forward setting of the eye, together with its elongate pupil, and the pronounced furrow in the face in front permit an unrestricted range of vision anteriorly, and the elongation forward of the pupil also admits of rays of light impinging upon the retina from a point far behind the eye. Proximately I estimate the range of vision as extending through an arc of 330°.

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* Rept. Brit. Ind., p. 306.

† Bom. N. H. Soc. Jour., Vol. X, p. 6.

‡ Spolia Zeylanica, Vol. I, Pt. II, June 1893, p. 1.

The neck is markedly contracted, and the body, which is very slender throughout, exhibits a maximum calibre about its middle, and attenuates in both directions. It is smaller in its lateral than in its vertical measurement (*i.e.*, compressed). The tail tapers very gradually, and is longer relatively in this snake and its allies than in any other varieties, measuring more than a third of the total length. The whole snake in its tenuity of outline resembles the lash of an English carriage whip ; hence its familiar name.

Colour.—The upper parts of head, body, and tail are bright verdant green, the surface of the scales dull. The ridge from the eyebrow to the snout is usually pale-green or yellow. Under ordinary circumstances no other colouration is apparent, but when under excitement the creature expands its body it brings into view alternate streaks of black and white (bluish in young specimens), which are directed obliquely downwards and backwards from the vertebral region. These are most apparent in the anterior two-thirds or so of the body, and upon close inspection are seen to be mainly produced by the colour of the skin between the scales ; however the lower borders of the scales themselves are also narrowly tipped. A well-defined narrow white or yellow line runs along the entire body flank on the sides of the ventrals, and ends at a variable distance along the tail. The chin and throat are white or blue, sometimes mottled yellow to a variable extent. The belly is an intensely brilliant green, of a hue distinctly lighter than on the back, and resembles the delicate shade seen in some freshly opened foliage, such as the mango or bamboo. A greenish colour is imparted to the spirit in which the specimen is preserved. Very rarely specimens are met with in which the colour is khaki, or olive brown. Another rare colour variety is mentioned, and figured by Russell,* in which the belly is cinereous grey between the flank lines, the rest of the snake being

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* Ind. Serp. Vol. 1, Pl. XIII.

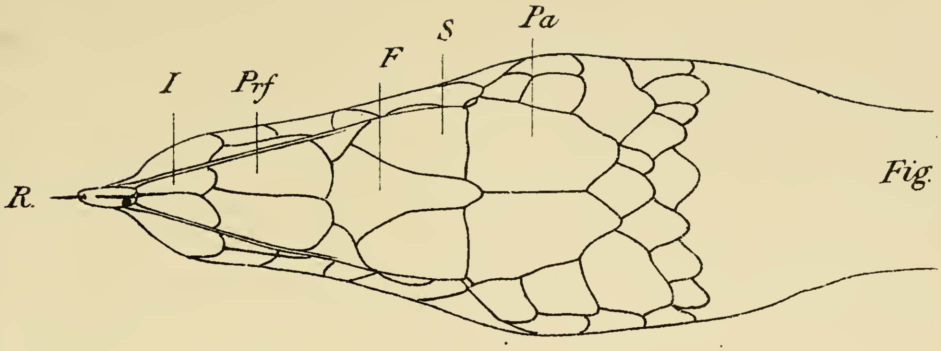

Fig. 4

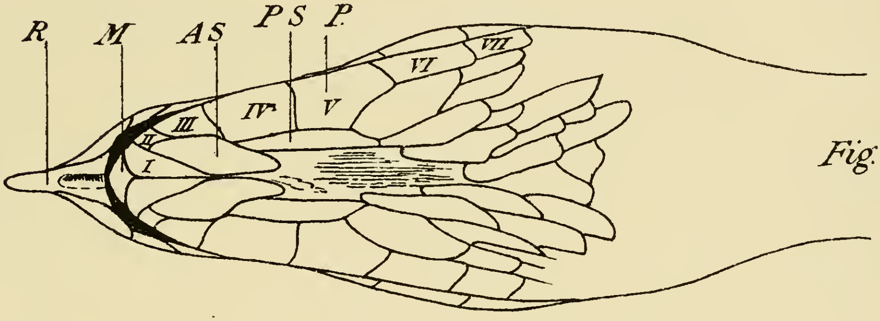
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Fig. 5

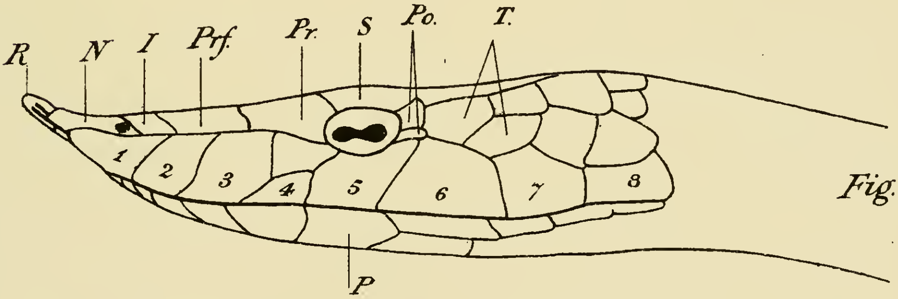
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Fig. 6

A. S.	Anterior sublinguals.
F.	Frontal
I.	Internasals.
M.	Mental.
N.	Nasal.
P.	Pentagonal infralabial.
Pa.	Parietals
Po.	Postoculars.
Pr.	Praeoculars.
Prf.	Praefrontals.
P. S.	Posterior Sublinguals
R.	Rostral.
S.	Supraoculars.
T.	Temporals.
1-8.	Supralabials.
I-VII	Infralabials.

DRYOPHIS MYCTERIZANS.

THE COMMON GREEN WHIP-SNAKE

× 2

A. P. CORTEZ & CO. LITH. BOMB.

Fig. 1.

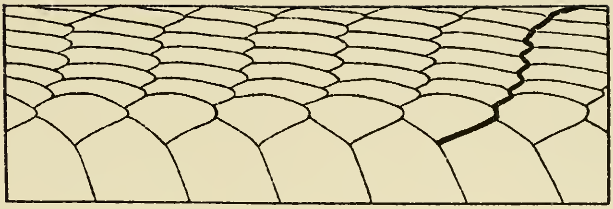


Fig. 2.

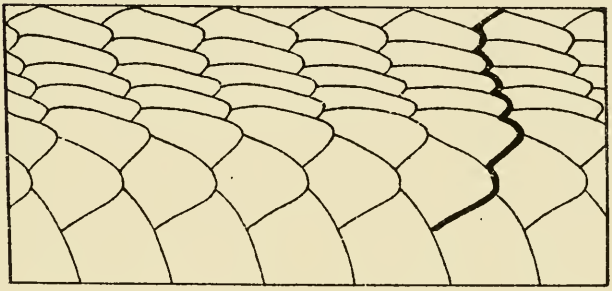
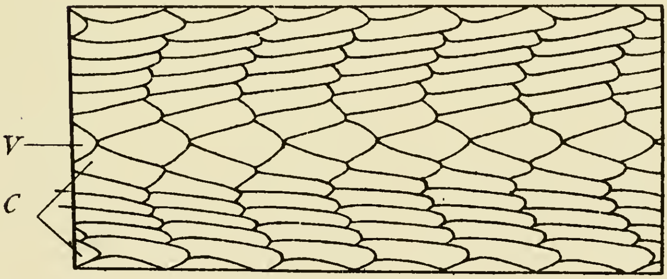


Fig. 3.



C. *Costals.*
V. *Vertebrals.*

DRYOPHIS MYCTERIZANS.

THE COMMON GREEN WHIP-SNAKE.

× 2

A. P. CORTEZ & CO. LITH. BOMB.

a normal green. I procured one such specimen some years ago in Trichinopoly.

Identification.—This snake belongs to a genus comprising six members, all bearing singularly pronounced features which readily distinguish them from all other snakes. Of these it is only necessary here to mention the pupil, which is horizontal in direction.

A fleshy elongated nasal appendage is peculiar to two only of the six, *viz.*, *D. mycterizans* and *D. pulverulentus*, and these are easily distinguished. The former is a common snake widely distributed, green with very rare exceptions, and marked with a white or yellow flank line always; whereas the latter is a rare snake peculiar to Ceylon and the Anamallay Hills in Southern India, brown in color, and with no flank line. To sum up, any snake with a horizontal pupil, an elongated fleshy appendage at tip of snout, and a white or yellow flank line must be *Dryophis mycterizans.*

Habits—Haunts.—It may be met with in high grass, but far more frequently on bushes, and will climb occasionally to a considerable height. I have known toddy collectors encounter it among the foliage of lofty cocoanut trees in Colombo on more than one occasion.

Disposition.—It is commonly reputed to be a very gentle snake (Boulenger, Flower. etc.,) and Mr. Ferguson* implies the same thing when he says that in Travancore it is the only snake the ordinary native is not afraid to handle. His next sentence, however, runs as follows: "Boys often bring them in, having first taken the precaution to tie up the head in a bundle of rags," and my experience compels me to think that the boys fully understand the vicious nature of this creature. I am very familiar with this snake, and have at the present time nearly one dozen specimens in captivity. It is very frequently brought in to me alive, and in the manner described by Mr. Ferguson. I do not find it, when freshly caught, at all the gentle, docile creature I have been taught to believe. When moderately alarmed it emits the tongue (which is a pale yellowish or pinkish organ) with closed jaws, keeping it out for a second or two or longer. If watched closely the two points are often seen to vibrate tremulously. The tongue is rarely protruded, and retracted repeatedly in the manner so common in other snakes. Whilst the tongue is maintained rigidly protruded in a forward direction the snake rears its head and forebody, and dilates the body so that the black and white interstitial skin becomes plainly apparent. If further excited it opens the jaws widely, and by a peculiar power widely separates the lower jaws, stretching the intervening skin very considerably, even so much as to double the lateral expanse of the floor of the mouth and make it shovel-shaped. The tongue is in the meantime kept retracted and invisible, but the opening of the windpipe is made conspicuous by the alternate dilatation and contraction of its orifice. Seen under these conditions with head retracted and upper body thrown into sigmoid curves, the snake presents a most formidable aspect. Even a small specimen will not hesitate to bite viciously, and will draw blood as I have occasion to know. I have been struck at most vehemently when my face has been opposed to the windows of the vivarium, and the act has been repeated several times by the same specimen after a lengthy term of captivity. Mr. Green says when pressed it will strike out blindly, often in the direction of the face of its opponent. Mr. Millard writes to me: "It is when freshly caught, very fierce and bites freely." It is certainly true that in captivity a very few days will serve to materially alter this pugnacious spirit in some specimens and then the snake will frequently permit itself to be handled with impunity. Natives in India and Ceylon believe that it strikes at the eyes of persons and cattle: hence the Tamil and Singhalese names for it. This idea has received support from the experience of Mr. Finn,* who, whilst holding two specimens in his hand, was bitten by one which darted at his eye. Two punctures were subsequently observed on the upper and one on the lower lid, and in rubbing his eye he removed a tooth from the wound in the lower lid. Among foliage it can move with great alacrity, but on the ground its movements are tardy. At rest it is always seen lying more or less extended on the branches, never coiled like members of the *Dipsadomorphus*. Its body is so slender and so light that by distributing its trifling weight, it is capable of moving among the minutest twigs.

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* Bom. Nat. Hist. Journ., Vol. X., p. 6.

Food.—Günther† says it feeds on birds and lizards. Green‡ says it feeds readily upon young lizards of the genus *Calotes* and *Geckonidæ*. Mr. Millard tells me geckoes, blood-sucker lizards, sparrows, and mice have been eaten by specimens in captivity. I have known one in captivity eat a frog, but in its native haunts my observations show that lizards of the genus *Calotes* are preferred to any other creature. Mr. Primrose* mentions a case of cannibalism practised by this snake, the victim being *Tropidonotus stolatus*. On investigating the dung of specimens I have frequently found it contain the scales of what were probably lizards, since no vestige of ventral shields were found such as would result from snakes being ingested. There have been frequently fragments of the cases of insects, such as cockroaches, and once I recovered a large black ant almost intact. After one in captivity had eaten a *Calotes versicolor* I isolated it, and examined the resultant excrement. From this I extracted, by softening the mass in water, the scales of the lizard which floated up, and also fragments of insects. In this case, I think, I am justified in supposing the insect remains to have emanated from the alimentary system of the lizard, as I never saw insects in the vivarium. Günther† and Boulenger‡ mention insects as the food of young *Dryophis prasinus*, a very closely allied member of the genus, and I wonder whether these observations were the result of direct experiment, or if conjectured from the examination of the dejecta.

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* Reported in the Jour. As. Soc. Ben., Vol. LXVII., 1898, pp. 66-67.

† Rept. Brit. Ind., p. 306.

‡ Spolia Zeylanica., Vol. I., Pt. II., June 1903, p. 2.

Green§ remarks: "Its manner of capturing its prey is invariable. When a lizard is introduced into the cage, the snake slowly frees the fore part of its body and coils itself in a zigzag fashion. Then, suddenly darting forward, it seizes the victim unerringly just behind the head, drags it from its support, and keeps it dangling without shifting its hold, but gradually tightening its grip, until the lizard is suffocated. * * * The snake never commences to swallow its prey until all signs of life have ceased." The Revd. F. Bertram, S.J., ‖ says: "It does not even always wait for its prey to be paralysed before eating it." And I agree with this remark, though it certainly does hold on to its victim till its struggles are of little avail. In this respect it differs from the dháman and cobra, which commence to swallow as soon as their prey is seized. When the victim has passed through the jaws, the snake rears itself vertically for nearly or quite half its body length, and then practises a series of contortions during which the forebody is thrown into shallow lateral undulations. The curves of the undulations are rhythmically reversed, and by this manœuvre carried out with much muscular effort the mass is propelled onwards to the stomach in a surprisingly brief interval of time.

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* Bom. N. H. Journ., Vol. XV., p. 347.

† Rept. Brit. Ind., p. 303.

‡ Faun. Brit. Ind. Rept. & Batrach., p. 369.

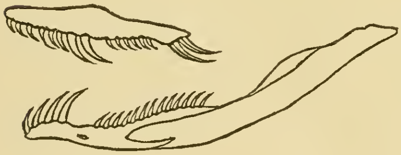
§ Spolia Zeylanica, Vol. I, Pt. II, June 1903, p. 1.

‖ Snakes and their Venom, Trichinopoly, 1897, p. 11.

Breeding.—This is one of the very few snakes whose breeding habits have been observed. The young are born alive, having previously burst their egg envelope within the mother's abdomen (ovoviviparous).

Ferguson * records one giving birth to twelve young on September 27th, 1891, in the public gardens at Trevandrum in Travancore. It had been in captivity since June 30th of the same year, so that the period of gestation was, at the very least, 59 days. I suspect it will prove to be much longer, for a specimen of an allied species (*D. prasinus*) which had been received in the London Zoological Gardens from Java on the 15th of August 1885, gave birth to 8 young on January 9th, 1888, having had no male companionship during this whole period.†

Green ‡ mentions another instance from Ceylon when one in captivity gave birth to five young on the 16th and 17th April 1903. The fifth, hampered by its egg envelope, succumbed two days later. All the brood sloughed on the eighth day after birth. A specimen received by Captain Evans and myself from Tadoungoo, Lower Burma, on the 23rd of May 1900 (with other snakes recently collected) contained three young with no vestige of egg envelope to be discovered within the mother. Evans has recorded another specimen in this Journal Vol. XVI., p. 169, killed (Rangoon?) on the 4th May containing 5 young, and Blanford (J. A. S. B., Vol. XXXIX., p. 373) mentions a specimen from Korba (Bilaspur C. P.) containing 4 large eggs.



Dentition of *Dryophis mycterizans*
(after Boulenger)

Poison.—This species for practical purposes is usually considered to be innocuous. It is furnished with grooved fangs situated at the hinder extremity of the maxillary. Its bite is reputed to be quite harmless to man, as the following quotation will exemplify. The Revd. F.

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* Bom. Nat. Hist. Jour., Vol. X, p. 6.

† P. Z. S., 1886, p. 124.

‡ Spolia Zeylanica, Vol. I, Pt. II, June 1903, p. 1.

Bertram,[*] S.J., records the testimony of a friend of his, who experimented on himself, in the following terms:—"I hold the fact from his own mouth. One day a lively green snake was brought to him, and he was assured that it had not spent its venom in any way previously. He put his finger into its mouth, took care to place it under the fangs, and then squeezed the jaws together, so as to drive the fangs into the flesh. * * * Well, no result followed, not the slightest ache of any kind." This substantiates in a very conclusive way the experiences of others. However, a *sampwallah* employed by me in Bangalore came to me on the 5th September this year and produced two green whipsnakes, male and female, which he declared, he had observed "in copulâ." In capturing them he was viciously bitten on the left hand by one of them, at about noon that day. At 4 p.m. when I saw him the hand and forearm were greatly swollen, and he said felt numb. He was in no pain. I saw him again a week later and he told me the swelling subsided in about two days and that he had felt none the worse in his general health. Russell[†] says: "Its bite on chickens tried repeatedly produced no other effect than pain." The poison gland is rudimentary, and my dissections and observations lead me to believe that it is solid like a mammalian salivary gland, and incapable of storing poison. Whatever truth may lie in this assertion, the potency of the poison must be admitted to be extremely feeble when Green[‡] says that young lizards will sometimes take 20 minutes to die in the grasp of its jaws, and on such a statement one may reasonably believe that the victim succumbed to mechanical influences alone. I lately witnessed one specimen in captivity seize and devour a frog. It grasped the frog's body close behind the forelimb, and held on tenaciously in spite of the frog in its struggles turning the snake over and over. After more than 20 minutes the snake began, through the agency of the jaws alone, shifting its grasp towards its victim's snout, and then commenced swallowing. Thirty-six minutes elapsed before the frog was wholly swallowed, and it was kicking feebly to the end. It has nevertheless been proved that the secretion of the parotid (salivary) gland has toxic properties. Major Alcock, I.M.S., F.R.S., and Captain Rogers, I.M.S., have conclusively demonstrated[§] that mice die when injected subcutaneously with a saline extract from this gland, and they sum up the results of their experiments in the following words. "No one who has experimented with minimal lethal doses of Cobra venom can fail to be struck with the close resemblance of the symptoms caused by it with those recorded in the above experiments with the parotid secretion of *Dryophis* and its Opisthoglyphous allies.

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[*] Snakes and their Venom, Trichinopoly, 1897, p. 11.

[†] Ind. Serp., Vol 1, p. 17.

[‡] Spolia Zeylanica, Vol I., Pt. II., June 1903, p. 1.

[§] Proc. Royal Soc., Vol. 70, p. 451.

The gradual quickening of the respiration, the drowsiness and nodding of the head, with jerky recovery every now and then, followed by gradually increasing paralysis, and a rapid failure of the respirations after they have become laboured in character, by convulsions, and finally by stoppage of the heart some little time after the breathing has ceased, form a sequence of events that except for a difference in intensity, are common to both, as also is the *post-mortem* picture of subcutaneous extravasation."

Distribution:

(*a*) *Geographical.*—India, Ceylon, Burma, Siam.

(*b*) *Local.*—It is essentially an inhabitant of the plains and low uplands but I have records of its occurrence at an altitude above 3,000 ft. (Salween, Burma). It frequents gardens and groves in populated quarters, as well as jungles far removed from habitations.

(*c*) *Numerical.*—Its frequency varies much in different localities. It is a common snake about Colombo, and a very common one in Travancore (Ferguson). It is extremely common about Cannanore, more so I think than is usual in other Southern Indian parts. It was by no means so plentiful about Trichinopoly. Russell* says "this snake is very common about Vizagapatam, and I believe, in the Circars, as well as in the Carnatic." Sclater† says this "snake, like many other Southern Indian species, extends north-westwards as far as Mount Aboo in Rajputana." In Burma it is hardly to be considered a common snake. Captain Evans and I procured 14 specimens out of a total of 694. One was found in Rangoon, and nine others came from other parts of Lower Burmah, two reached us from Upper Burma, and two from East Salween. Mr. Hampton writing from Mogok, Upper Burma, says: "I do not think it is found about here. Its place is taken by *D. prasinus.*" Flower‡ mentions having seen five specimens from Bangkok. The brown variety is very rare. Werner* mentions one, and Mr. Millard tells me the first received by the Bombay Natural History Society was recently obtained from Malabar Hill, Bombay. The variety with the ash-grey belly is also very rare.

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* Ind. Serp., p. 17.

† Journ. As. Soc. Ben., Vol. LX., Pt. II, 1891.

‡ Proc. Zool. Soc., Lond., 1899, p. 682.

Description.—*Rostral* very narrow, projecting. A furrow above, and two laterally on each side. Undersurface slightly arched, and produced backwards twice as far as upper. Contact with six shields. *Internasals* two. Suture between them $\frac{2}{3}$-$\frac{4}{5}$ that between the præfrontals. In contact with 1st and 2nd supralabials. *Præfrontals* two. In contact with internasals, 2nd and 3rd supralabials, præoculars, and frontal. (2nd labial only, if loreals present, which rarely happens.) *Frontal.*—Length $\frac{1}{3}$-$\frac{1}{4}$ larger than supraoculars. Breadth $\frac{1}{2}$ each supraocular or less. Contact with eight shields; the supraocular sutures at least three times as large as each of the rest. *Parietals* contact with one postocular. *Nasals* single, lateral, elongate, pierced at extreme posterior angle by a small nostril; in contact with one supralabial, *viz.*, the first. *Loreal* absent normally, rarely one or two present. *Præoculars* one,† in contact with frontal. *Postoculars* two, small. *Temporals* one normally, rarely two.

Supralabials normally 8, the 4th divided into one or two upper and one lower part, the 5th only touching the eye. Sometimes there are 9, and then the 6th only touches the eye. *Infralabials.*—The first meet behind the mental to form a suture about equal to that between the anterior sublinguals; 4th and 5th largest; 5th pentagonal, 2 or 3 times as broad as posterior sublinguals and in contact with two scales behind. *Anterior sublinguals* subequal to, or rather smaller than, the posterior; normally in contact with the first 4 infralabials. *Posterior sublinguals* have no intervening scales; come into contact with the 4th and 5th infralabials normally. *Scales.*—Two heads lengths behind head 15; midbody 15; two heads lengths before vent 11-9. At both steps, where the scales reduce from 15-13 and 13-11, it is the 5th row above the ventrals that disappears, being absorbed into the row above or below. The vertebral row is enlarged, and its scales different in shape from the costals, which are elongate, and set obliquely. The scales of the last row are much the largest, those in the superjacent rows have their anterior-superior and posterior-inferior borders far the shortest. The scales in all snakes overlap in two directions, *viz.*, from above downwards and below upwards, but the shape of the costals in this genus makes the overlapping from below upwards far the more evident. The relationship of the vertebral and the last row with their contiguous rows remains the same in the whole length of the body, but the intermediate rows alter in a remarkable way, peculiar, I believe, to this genus. The intermediate rows, *i.e.*, 2nd from the ventrals to the 7th, when looked at in a transverse direction, are seen to be placed one behind the other from below upwards in the front of the body, but this alters, and these rows gradually acquire a contrary relationship which is seen in the middle and posterior parts of the body. The thickened lines in figures 1 and 2 are intended to illustrate this point. *Keels.*—Carination is indistinct, and confined to a few median rows about the anal region, the keels being nodulated in character. *Supracaudals* are in even numbers; four in the middle of the tail. They decrease at each step by the fusion of the two uppermost rows on each side. *Ventrals* 168-206 rounded; if the specimen is laid on its back, barely a portion of the last costal row can be seen on each side simultaneously. *Anal* divided. *Subcaudals* 127-174, divided. *Dentition.*—Maxillary teeth 12-15, one or two in the middle much enlarged, fang-like, and followed by an interspace, after which the teeth are very small; one or two posterior grooved fangs, situated below the posterior border of the eye; mandibular teeth increasing in length to the third or fourth, which is very large and fang-like; the posterior small (Boulenger). Pterygoid about sixteen, subequal, and small.

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* Verh. Ges. Wien, Vol. XLVI., p. 362.

† The upper divisions of the 4th supralabial may be considered by some as præoculars, in which case there are two or three.

ADDENDA.

This paper was written eighteen months ago since which time I have acquired information which calls for some additions and modifications.

1. Here I follow Boulenger. All herpetologists have expressed very different views with regard to this snake. The fact is the characters upon which the classification of snakes is based, are very variable in this genus, and it is therefore almost impossible to draw hard, and fast rules to separate some of the species, and especially this one. I think from the specimens I have examined, it is more than likely that Boulenger's conception of this species will require further modification.

As it stands now he includes under the same title the *albolabris*, *elegans*, and *viridis* of Gray; the *gramineus*, and *erythrurus*, of Günther, Cantor, and Theobald; and the *gramineus*, *erythrurus*, and *mutabilis* of Stoliczka.

2. The shape of the head is variable. There are two distinct forms. In one the broadest part is at a point close behind the eyes, behind which it decreases so as to resemble the shape in the genus *Dipsadomorphus*. This form is shown in our plate. In the other the greatest breadth is at the angles of the jaws, the head then exhibiting that triangular shape which is popularly considered characteristic of a poisonous snake. There is no greater fallacy than to suppose a poisonous snake can be recognised by the shape of its head.

3. In the Andamans and Nicobars a very distinct variety occurs, in which the prevailing colour is brown. In some of these the hue is uniform, in others it is variously mottled, spotted, or barred with darker or lighter shades. In this locality the brown specimens are more plentiful than the green.

4. Though these remarks are true of the uniform green specimens, some modification is required to include all the colour varieties, and makes the recognition of the species much more complicated. The following points must coexist:—(1) Head covered with small scales throughout; (2) Scales in 19 to 23 rows in the middle of the body; (3) Supraocular undivided; (4) Presence of subocular; (5) 9 to 12 supralabials, of which the second in its upper half is furrowed into the loreal pit.

5. Father Dreckman once captured a famale specimen, which gave birth to seven young, while he held her in his grasp. This is the only authentic record I know of to prove that this species is viviparous. One youngster of the brood I examined measured 9½ inches.

6. Mr. Thurston, the Superintendent of the Madras Museum, tells me that he once received a specimen from Nellakota in the Nilgiri Hills.

7. I have since received a specimen 6 feet and ½ an inch in length.

I may here remark that the figure of this snake by Frohawk in the Encyclopædia Brittanica: and that by Smit in the Fauna of British India, Reptilia, Boulenger, 1890, are to my mind purely fanciful and inaccurate. The snake does not wrap itself round branches in the intricate fashion depicted, at least not in a state of nature. I very much suspect these drawings were made from museum specimens, and arranged thus by the artists who had never seen them in life.

Our plate is from life. Mr. Green painted them from specimens in the London Zoological Gardens, and his work is excellent. In figure 8 the infralabial shields are abnormal. Only 4 (not 5) normally touch the anterior sublingual shields, and the 5th (not the 6th) is normally the largest of the series.

(*To be continued.*)

NOTES ON RHINOCEROSES IN BURMA, *R. SONDAICUS* AND *SUMATRENSIS.*

BY

VETY. MAJOR G. H. EVANS, F.L.S.

Information relating to some of the species of Asiatic Rhinoceroses in the various works I have consulted appears very incomplete. In order to add to it, it is desirable on the part of those who have any acquaintance, however small, with these animals or their habits to place such on record. Though I consider, I have not had the luck in shooting them that I deserve, hunting them has afforded me an opportunity of learning a little of their habits.

There are in Burma two species for certain, *viz.*, the larger and single-horned variety of the Burmans, *R. sondaicus*, Kyan-hsin or Pyan-hsin (elephant-rhinoceros) and the lesser double-horned, *R. sumatrensis*, Kyan. On the authority of the late Dr. Mason, Kyan is the generic term in Burma for a rhinoceros, signifying "to be firm in structure and mind." They are known to the Karens as Ta-do or Ta-do-khaw, and to the Shans as Sawon.

Both species may occasionally be met with inhabiting the same stretch of country and visiting the same pools or wallows. Burmans and Karens, as a rule, with the exception perhaps of the hunters, are much afraid of these animals, and this is perhaps not to be wondered at if we bear in mind the very ferocious character attributed to them. They are said to attack human beings without provocation, and to be most vindictive and persevering in their pursuit of the object of their anger; they do not fear elephants or tigers. Furthermore they are credited with not only stamping out but even devouring fire, and rushing in the direction of any noise they may hear. A record such as above should inspire awe in anyone believing the stories. I cannot learn anything as to how the idea of their distaste for fire arose; it is certain, however, that it is a story very generally accepted by the Burmans. That they are unsuccessful in keeping down forest fires about their haunts would by these people be attributed to the fact of their numerical weakness. Burmese and Karen hunters, who in days gone by had some experience in hunting rhino, appear to be unanimous in considering them dangerous animals, and especially so when wounded. This has also been the experience of two or three Europeans over here.

Though in exceptional cases an individual may be of a vicious temperament and inclined to be troublesome without provocation, or to charge when suddenly disturbed, as when lying down (as many kinds of animals may do), my small experience tends to make me believe that a rhinoceros is as anxious to preserve a whole hide as most other beasts. I have more than once in dense cover been closer than I really liked without being able to obtain a reasonable shot, the animal knowing he was being hunted. So far I have not had one turn on me, for which I am not sorry, not having the smallest desire that one should do so as I have learned that however ungainly and awkward their appearance may be it is a pure fallacy to consider them wanting in agility. On the contrary they are astonishingly agile. When wounded, if the assailant be in view and the animal not too sick he may charge, and he is, as I have remarked, an active and dangerous beast and what is worse requires some stopping. I have only heard of a couple of instances in which unwounded animals have given trouble. On one occasion two rhino held up a party of survey coolies in the course of their work, and on the other a rhino chased a gun bearer or hunter who managed to climb a tree, but had not got far enough up before the rhino overtook him and was able to give him a bite as well as afford him a hoist up. The Burmans state that in attacking, these brutes use their incisors freely, also the horn, and finish up by trampling on their adversary.

Mason in his work on Burma, Volume 1, page 451, writes thus:—"The common single horned rhinoceros is very abundant. Though often seen on the uninhabited banks of large rivers as the Tenasserim they are fond of ranging the mountains, and I have frequently met with their wallowing places on the banks of mountain streams two or three thousand feet above the plains."

During the past twenty years at least, and in spite of most guns having been withdrawn, I do not think anyone in the province would consider either species abundant or common, or even moderately so anywhere. If they are still so it must be in tracts most inaccessible and little visited by Europeans. It is probable that, confining themselves as they often do to localized areas, four to six animals or even a couple wandering over such, by crossing and recrossing, would make numerous tracks in many directions and this, taken in conjunction with the fact that in such areas pools and wallows would be met with which they had entered, might without due consideration lead to the impression that rhinoceroses are abundant.

I believe, however, that in the aggregate there is a fair number of animals scattered over the country. So far I am under the impression that *R. sumatrensis* is the more common.

During a residence of several years I can only recollect some eight or nine specimens of *R. sumatrensis* and two of *R. sondaicus* being shot by European sportsmen. This cannot be said to be a large number if we consider the many Europeans who tour about the country on duty, prospecting, or in search of heavy game. In several instances the specimens of *sumatrensis* were come on unexpectedly, *i.e.*, the lucky individuals who were on the march or in pursuit of other game were unaware that rhino were to be found anywhere in their proximity. Some experience of the class of country they are most likely to be found in, leads me to the belief that as far as their pursuit goes, they are likely to enjoy immunity from annoyance, except from a few of the more ardent sportsmen.

Distribution.—They are to be met with in certain areas of the hilly tracts in Upper and several of those in Lower Burma.

Habits.—Both species in this country show a decided preference for hilly tracts and even mountainous country. I have met with tracks of both varieties at considerable elevations, especially in places infrequently visited by men. They appear to be of a restless disposition and at times given to wandering a distance from their accustomed haunts. In the hot season they are invariably found in hilly or mountainous country, by no means necessarily well wooded, but where shade is sufficient. They rarely range far from the perennial streams in which there are usually numerous pools of cool water and abundant shade. Those streams with rocky and shingly beds are preferred. The feeder streams or gullies are also worth visiting. They are extremely partial to water, and enter the pools during the night and also visit them during the heat of the day. In suitable places there are regular mud baths or wallows, some large and patronized by elephants, etc., and others much smaller. They evidently enjoy rolling in wet mud as much as buffaloes and hogs do. They visit the pools singly or may be found two together, usually a bull and cow. The night, early morning and evening is spent wandering about grazing, etc., and during the day they lie up in shade on the hillsides or on the top of the ridges above the streams.

In the cool weather they may wander a good deal as also during the rains, ranging along the ridges and visiting the head waters of streams. During the rainy season *R. sumatrensis* certainly tours through the lower-lying country, as their tracks are to be met with within, in some places, three or four miles off the railway. They do not, I think, remain for any length of time, but come down only in search of particular kinds of fodder not obtainable at other times.

With regard to the nature of their food I am inclined to think that these rhinoceroses are not great grass-feeders, but prefer to browse on leaves, twigs, shoots, etc., and they seem very partial to fruits.

In the dry season the stomach generally contains wild mangoes, figs, *Cicca macrocarpa,* leaves of trees and bamboo leaves. The fruit or leaves, etc., of the following are eaten by these animals, *viz.,*—the fruit of the ' Myauk-tanyet ' (*Parkia insignis,* Kurz). The figs of the ' Sin-tha-hpan ' and ' Tha-hpan, ' which I find to be *Ficus roxburghii* and *F. glomerata,* but I had doubts as to the Burmans being correct as I have heard these names applied to other trees of this natural order. One point may afford a clue to the species and that is the size of the fruit, which is as large as an ordinary apple. The fallen fruit of the *Cicca macrocarpa,* ' Zibyu'; *Careya arborea,* ' Ban-bwe'; *Sandoricum indicum,* ' Thit-to,' and also that of the ' Byu,' *Dillenia pulcherrima.* The leaves, twigs, etc., of the *Castanopsis diversifolia* and *tribuloides* (Kurz), *Toddalia aculeata* (Kurz) ' Kyan-sa' or ' Pyan-sa ' (lit. rhinoceros-food). ' Satsha ' of which Kurz mentions the *Boehmeria hamiltoniana, Sarcochlamys pulcherrima, Trema orientalis* and *Maoutia puya.* The ' Ta-bu ' or ' Ta-mu,' *Harrisonia bennetii* and *Sonneratia acida.* The twigs, shoots and leaves of the bamboo are also freely partaken of, no doubt those of the most plentiful variety of bamboo growing in their haunts. That found in the stomachs of two animals was that of the ' Kayen-wa,' *Melocanna bambusoides* (*baccifera*). They are undoubtedly partial to this bamboo, and to some extent localities in which it grows. It is a peculiar and graceful bamboo, grows singly and to a height of fifty feet and over. Each shoot comes up more or less equidistant from its neighbours, and this regularity causes a ' Kayen-wa' jungle to resemble a plantation.

Their most acute sense appears to be that of smell, and, I think, they rely much more on it than sight or hearing. Making a certain amount of noise, walking through the jungle, will not always disturb them, and they assuredly are not very quick of sight, but the faintest puff of wind is more than enough.

The habit of depositing its ordure in one place as attributed to the African species and *R. indicus*, does not apply to these rhinoceroses, that is, if it is understood to mean that this is a place repeatedly visited for that purpose. Small heaps or mounds, perhaps the droppings of a week, may be found on the hillsides, where they lie up daily. But as a general rule I do not think they can be at all particular in the matter, as one habitually finds single droppings on their tracks on the sides of hills, ridges, etc., and an abundance of them scattered about in the beds of streams. If the pools in which they lie be disturbed one has rapid olfactory evidence that they contain more than a small quantity of their droppings. In appearance they are much the same as that of an elephant.

Burmans and others could afford no information of value as to the period of gestation. I have only twice come on the tracks of young rhinoceroses evidently at heel, and these in January.

Perhaps the most interesting feature about these creatures is the astounding way in which they ascend and descend the steepest of hill-sides. In fact the steeper the gradient the more it would appear to appeal to them. As for many of the descents into the beds of streams, they are quite in the nature of slides. For a human being, certainly, a leather seat would be of greater help to him than anything else. It is equally surprising how they ever manage to climb over some of the rocky places one meets with, yet they do. They are the most difficult animals I have ever attempted to follow. I thought serow and goral quite bad enough, but rhinoceros, I think, can give them points.

The Burmans attribute their agility to the fact of their possessing three large separate claws or hoofs. In descending, only the centre one is in use, the lateral ones being employed as brakes. Going over rocks, ledges, etc., one or more toes may be employed. One thing is certain, *viz.*, that Karens and Burmans are as much astonished as we are at the way they get over seemingly impossible ground.

As regards dentition, in the skulls I have seen it is quite as irregular as has been noted by various observers.

The only sound I have heard is a kind of grunt or rather a short harsh blowing sound. I heard one, a *sondaicus*, emit this noise when evidently surprised in cover. He heard us and had not got the wind. On being hit, unless killed outright, they usually grunt, and also do so while charging. Burman hunters say that rhinoceroses are very tenacious of life after being wounded. No doubt with the weapons they used on them they were so; the wonder is they killed them at all. As with any other kind of game, I do not think any one has a right to press trigger unless he has a reasonable shot, giving a fair chance of bagging the animal.

Pace.—When disturbed they set off at a smart gallop making a great deal of noise by rushing through all minor obstructions and as a rule making more noise than a solitary elephant. Following up immediately is generally of little use as after being disturbed they usually travel a long distance and keep a sharp look-out. It is therefore, as a rule, better to give up the hunt and take up the tracks at dawn on the following morning.

The track of a rhinoceros is unmistakable. The presence of the impress of three claw marks is sufficient, that of *sondaicus* differing only from *sumatrensis* in size.

I have heard it said and believe it is recorded that rhinoceroses cannot swim. In common with many popular ideas it is a pure fallacy. They swim well, crossing rivers, etc., when they desire to do so. I remember an instance in which one was killed while crossing the Tenasserim.

It is unnecessary to enter into a description of these animals as this may be found in various books on Natural History.

Burmans and Chinamen place a very high value on the horns and blood of rhinoceroses as medicinal articles. Wherein their virtues as drugs lie I do not know, but they are supposed to be most potent, especially in all diseases not yielding to ordinary drugs. I expect their fictitious powers are derived from the fact that, like the milk of a tigress or liver of crocodile and such other materials, they are not easily get-at-able nor always at hand to include in prescriptions. The local doctor, in the event of his patient doing badly, can always save his reputation by claiming that if he had some of these potent remedies he could still effect a cure.

After hitting a rhinoceros, if he is considered to be 'in extremis' the tracker and any followers are down on him like vultures, the first thing, an all important business, being to plug any bullet holes in order to save as much blood as possible. If any be escaping rapidly from a wound a bamboo is there ready to receive it. Any blood that is on the ground and lost, occasions some grief.

The blood is carried in lengths of bowel and thoroughly dried over a fire so as to resemble those queer articles of diet popularly known as 'black puddings'. It is sold at the rate of a rupee for every rupee in weight.

The flesh of these animals is said by Burmans, etc., to be very good. A friend of mine declares it is so and that the liver is perhaps better than that of some other animals. I have not tried any myself being contented with ordinary fare.

Measurements of R. SUMATRENSIS—*Male.*

Height at shoulder (between uprights)	52½"
Length nose to dock	98"
Girth behind shoulder	85", 86"
Tail (docked)	13½"
Girth fore-arm	28½"
Length of head	32"
Length of ears	7½"
Length of anterior horn	7⅛"
Length of posterior horn	3½"

Measurements of skull, not taken.

Measurements of R. SUMATRENSIS—*Female,*

I have recorded in Volume XVI., No. 1, page 160, of this Journal.

THE ORCHIDS OF THE BOMBAY PRESIDENCY.

BY

G. A. GAMMIE, F.L.S.

PART II., (WITH PLATE I.)

(*Continued from page* 433 *of this Volume.*)

The first step towards the identification of an orchid is to refer it to its tribe, and the second is to find out the genus to which it belongs.

It is usual to subdivide these tribes again into subtribes, but as the number of genera represented in Bombay is small and as such a complexity of detail would probably repel a learner, it will suffice to discuss the genera under tribes only.

The first tribe *Epidendreæ* is well represented, and the genera comprised within it may be shortly summarized as follows :—

* *Pollinia* 4, not appendaged.

1. OBERONIA.—Small tufted epiphytes with thick two-ranked leaves. *Flowers* minute, in very dense round spikes like rats' tails.

2. MICROSTYLIS.—Terrestrial. *Leaves* rather broad and thin. *Flowers* small, reversed, *lip* fan-shaped.

3. LIPARIS.—Terrestrial. *Raceme* stout or slender, *lip* broadly and inversely heart-shaped.

4. DENDROBIUM.—Containing plants of varying habit and best discussed under sections.

Section I.—*Cadetia.* *Stems* branched, pendulous, bearing a series of single-leaved pseudobulbs and small white flowers in clusters of 2 or 3.

Section II.—*Stachyobium.*

(*a*) Small plants with crowded, ovoid pseudobulbs, *flowers* small, in racemes.

(*b*) Larger plants with long, cylindrical, leafy stems, *flowers* larger and more numerous in the racemes.

(*c*) *Stems* slender, excessively branched, *flowers* small, white.

Section III.—*Eudendrobium.* *Stems* tufted ; *flowers* pink or yellow in short racemes or in pairs from the joints of the leafless stems.

5. BULBOPHYLLUM.—Epiphyte. *Rhizome* creeping, bearing one-leaved, ovoid pseudobulbs, *racemes* moderately dense, *flower* yellow with brown lip.

6. CIRRHOPETALUM.—Epiphyte. *Rhizome* bearing, globose, one-leaved pseudobulbs, *flowers* radiating in an umbel, *lateral* sepals very long.

7. TRIAS.—Epiphyte. *Rhizome* creeping, bearing small pseudobulbs, *flowers* small, solitary.

* * *Pollinia* 8, not appendaged.

8. ERIA.—Plants of varying habit grouped in the following sections :—

Section I.—*Porpax.* Small plants with depressed, crowded pseudobulbs, clothed in a network of fibres. *Flowers* 1 to 3, sessile on the top of the pseudobulb.

Section II.—*Conchidium.* Small species as above. *Flowers* solitary or in a short raceme from the top of the pseudobulb.

Section III.—*Bryobium.* Also a small species. *Pseudobulbs* clustered, depressed. *Spikes* 1 to 3 inches long, many-flowered.

Section IV.—*Hymeneria.* *Pseudobulbs* long, thick. *Racemes* from amongst the leaves.

* * * *Pollinia* 8, cohering in fours by granular appendages.

9. PHAJUS.—Epiphyte, tufted. *Leaves* two-ranked, thin, deciduous ; *flowers* showy, in dense terminal heads.

* * * * *Pollinia* 4, connected by an appendage.

10. JOSEPHIA.—Epiphyte, stemless and tufted. *Leaves* radical, leathery. *Flowers* very small, in panicles.

11. PHOLIDOTA.—*Rhizome* creeping. *Pseudobulbs* large, with single leaves. *Racemes* long, pendulous, bearing prominent and closely set brownish, two-ranked bracts.

Descriptions of the plants belonging to the tribe Epidendreæ.—[Unless otherwise mentioned these have been taken from living examples. The paragraphs placed within brackets and signed with the initials K. R. K. are from notes supplied by Lieutenant-Colonel Kirtikar, I.M.S. (retired).]

1. OBERONIA.

Fleshy epiphytes, usually growing in clusters on the trunks of trees. *Leaves* laterally compressed, few, two-ranked, crowded, green or brown in colour, sword or slightly sickle-shaped, thickest in the middle and near the base, thinning upwards and also towards the margins. *Flowers* very minute in dense cylindrical spikes, *sepals* subequal, *petals* smaller, *lip* 2 to 4 lobed, *column* very short, *pollinia* 4, waxy.

Small plants.

Lip with 3 distinct lobes ... ... 1. *O. recurva.*

Lip almost oblong ... ... 2. *O. falconeri.*

Larger plant.

Lip broader than long, midlobe bifid or trifid. 3. *O. platycaulon.*

1. Oberonia recurva, *Lindley* Fl. Br. Ind. V. 680; Dalz. and Gibs, p. 260.

Sometimes very minute and seldom more than 2 or 3 inches high, including the inflorescence, *leaves* oblong, lanceolate acuminate green, *peduncle* short, *bracts* entire, *flowers* minute, yellowish red, *lip* minutely gashed on the margin, lateral lobes distinct rounded mid lobe bifid sinus usually narrow.

Distribution.—Throughout the whole of the Ghats and Konkan. Flowers in the dry season.

2. Oberonia falconeri, *Hook. f.* Fl. Br. Ind. V. 678.

A slightly larger plant than the above but similar in appearance, *bracts* slightly toothed, *flowers* yellowish, *lip* inversely heart-shaped, oblong, margins entire, lateral lobes almost obsolete, midlobe with two small, incurved, well separated divisions leaving a broad sinus.

Distribution.—This plant may be plentiful in the Konkan, but it has only been received from *W. S. Millard,* who obtained it from Kalyan in flower in September. It is also recorded from the Tropical Himalaya, Kumaon, Dehra Dun, Behar and Chutia Nagpur.

3. Oberonia platycaulon, *Wight.* Fl. Br. Ind. V. 682.

Leaves narrowly sword-shaped acute, 6 to 10 inches long, *peduncle* broad flat joined to a leaf to the top, *spike* 3 to 5 inches long, straight *bracts* broad obtuse, gashed on the margins, sheathing the sessile ovary *flowers* $\frac{1}{5}$ inch in diameter, *petals* narrow, *lip* broader than long, with broad, rounded lateral lobes and a very short bifid or trifid terminal one.

This species is unknown to me and the description has been taken from the Flora of British India.

Its distribution is said to be from the Konkan to the Nilgiris and Pulneys.

Dalzell and Gibson, Bombay Flora, page 260, describe Oberonia Lindleyana, *Wight,* as growing on trees on the Ghats. Their description is not referred to in the Flora of India, and I do not know the plant. There is still another large species to be described. It is rare on the Kanara Ghats and my specimens, notes and drawing were unfortunately lost when the Herbarium of the College of Science was destroyed by fire some years ago.

2. MICROSTYLIS.

A terrestrial plant. *Stem* elongate, with 3 to 5, membranous, ovate acute leaves with sheathing stalks. *Flowers* small, in terminal racemes, *sepals* and *petals* spreading, *lip* flat, produced upwards into pointed auricles, *column* very short, with short spreading arms *pollinia* 4.

1. MICROSTYLIS RHEEDII, *Wight.* Fl. Br. Ind. V. 690 ; Dalz. and Gibs., p. 260.

Stem 6 inches high, stout, *leaves* usually suffused with brown, 5 to 7 nerved, pleated, stalk up to 3 inches long, blade from 3 to 7 by 1 to 3 inches, base often unequal, *raceme* slender, *bracts* lanceolate, deflexed, *flowers* fragrant, greenish yellow or purple, *lip* kidney or fan-shaped, finely toothed all round the margin.

Distribution.—Common throughout the Ghats, more especially southwards. Flowers appear from June to August. Birdwood remarks that this plant is very like a Plantago.

3. LIPARIS.

Terrestrial or epiphytic. *Leaves* membranous, base sheathing, *flowers* small, *column* long, *pollinia* 4.

1. LIPARIS DALZELLII *Hook. f.* Fl. Br. Ind., V. 698.

Stem 4 inches long, as thick as the thumb. *Leaves* 2 to 3, sessile elliptic ovate acute. *Raceme* stout, *bracts* lanceolate, *flowers* ½ inch in diameter, *sepals* 5 nerved, obtuse, *lateral* falcately oblong, *dorsal* large, linear oblong, *lip* broadly inversely cordate, fleshy, dark purple, base bituberculate, *column* stout, incurved, wings rounded.

Distribution.—South Konkan (*Dalzell*) according to Sir J. D. Hooker, from whom the description is taken. The plant is unknown to me and it is included by Woodrow in his list with this citation only.

2. LIPARIS (*paradoxa, Reichb. f.*) Fl. Br. Ind., V. 697.

Pseudobulb ovoid, 1½ inch long, invested with loose sheaths on the narrow neck. *Leaves* 2, leathery, sessile, ovate-lanceolate, acute, four by two inches, multicostate. *Raceme* about 8 inches high, *rachis* quadrangular, angles slightly winged, bracts linear lanceolate, $\frac{5}{16}$ inch long, strongly reflexed, *flowers* ½ inch long, thinly scattered on the upper half of the rachis, green with a yellow tinge, *dorsal sepal* oblong lanceolate, margins strongly recurved, *lateral* subequal and similar to dorsal, *petals* as long as sepals, linear, margins strongly recurved, *lip* green obcordate, bituberculate at base and channelled on the disk, margins slightly crenulate, *column* incurved with narrow wings.

Distribution.—Collected in flower on the Belgaum and North Kanara Ghats in August, by Mr. T. J. Spooner, who kindly communicated living specimens to me. Having no means of comparison I am at present quite uncertain as to what name this plant should bear.

4. DENDROBIUM.

Epiphytes, *Stems* elongate. *Flowers* in racemes, *sepals* subequal, the lateral connected obliquely with the foot of the column and forming with it a sac; *lip* contracted at the base, *side* lobes usually embracing the column which is short, *pollinia* 4, a combined pair in each cell.

Section I—*Cadetia* (character given in list of genera).

Flowers white, *lip* yellow ... ...1. *D. macraei.*

Section II.—*Stachyobium.*

(*a*) *Sepals* and *petals* white, *lip* pink with dark red veins ... ...2. *D. microbulbon.*

Sepals and *petals* white, *lip* yellowish green ... ...3. *D. mabelæ.*

(*b*) *Flowers* greenish yellow ... ...4. *D. chlorops.*

Flowers white, suffused with rose ...5. *D. barbatulum.*

(*c*) *Flowers* white ... ...6. *D. herbaceum.*

Section III.—*Eudendrobium.*

Sepals and *petals* yellow, *lip* with purple nerves and thick, soft, hairs ... ...7. *D. macrostachyum.*

Flowers waxy, shining rose colour, *lip* yellow ... ...8. *D. crepidatum.*

Differing from above in the sepals, petals and lip being equal and similar in colour. *D. crepidatum*, var. *avita.*

Section I.—*Cadetia.*

1. Dendrobium macraei, *Lindl.*—Fl. Br. Ind., V. 714; Dalz. and Gibs., p. 260.

Pseudobulbs spindle shaped, *leaves* leathery, sessile, oblong obtuse. *Flowers* reversed about ¾ inch long, *sepals* and *petals* white spreading, linear lanceolate acute, *lip* yellow with pink suffusion, lateral lobes obtuse, midlobe with two diverging crisped lobules, disk between the side lobes with two fleshy crests.

Flowers from May onwards to the end of August.

Distribution.—Common on the Belgaum and Kanara Ghats. Occurs also in the Sikkim, Himalaya, Khasia Hills, Nilgiris, Ceylon and Java.

It forms large masses on the branches of trees and the small white flowers, owing to their position at the very bases of the leaves, often escape observation.

Section II.—*Stachyobium.*

(*a*) Small plants with crowded ovoid pseudobulbs, *flowers* small, in racemes.

2. DENDROBIUM MICROBULBON, *A. Rich.*, Fl. Br. Ind., V. 716; Dalz. and Gibs., p. 261; *D. crispum*, *Dalz.* in Hook. Journ. Bot. IV., p. 111.

Pseudobulbs small, crowded, ovoid, covered with a network of fibres formed by decaying leaves. *Leaves* quickly falling away, when present one or two from the top of the pseudobulb, linear oblong acute, 2 to 3 inches long. *Raceme* erect, 1 to 2 inches long, with usually 4 to 8 flowers, *bracts* small, *flowers* about ½ inch in diameter, *sepals* and *petals* white, *lip* pink with dark red veins, midlobe crenulate, suborbicular, lateral almost entire.

Distribution.—A common small plant throughout the Ghats and Konkan, growing on many species of trees and shrubs. Dalzell and Gibson say that it flowers in July and August. I have only found the flowers throughout the cold weather from December to March.

3. DENDROBIUM MABELÆ, *n. sp.*

Pseudobulbs small, tufted, two jointed, oval, ¼ inch long or as much as four jointed and 1½ inch long, joints clothed with large equitant papery scales which decay, leaving their nerves as a net work of fibres. *Leaves* 2, terminal, caducous, linear oblong, 3 inches long, moderately firm. *Raceme* half as long again as the leaves and rising from between them; *flowers* ½ inch in diameter, semipatent, reversed, 3 to 4 or more, terminal, *peduncle* slender, bracteate at base and towards the middle, *pedicels* with short bracts, ¼ inch long including the ovary, *sepals* white, sub-falcate, upper narrower than the two lateral which are produced at the base into a short, conical, incurved spur, *petals* white, oblanceolate, equalling the upper sepal, *lip* yellowish-green, with faint rose blotches and streaks, hinged on the extremity of the column foot, compressed lunate in outline, slightly 3-lobed, lateral lobes shallow, rounded, entire, terminal equalling half the whole length of the lip, subquadrate, emarginate, margins crinite with two rows of irregular, thick, white hairs, *disk* with a channelled ridge which is free and bilobed at the end, extending as far as the lateral lobes.

A small plant locally common on the branches of trees and shrubs on the Belgaum ghats and probably extending into Kanara.

Flowers during the month of October.

(*b*) Large plants with long, cylindrical, leafy stems, *flowers* larger and more numerous in the racemes.

4. DENDROBIUM CHLOROPS, *Lindl.*, Fl. Br. Ind., V. 719 ; Dalz. and Gibs., p. 261.

Stems up to 18 inches long, usually rather slender, *leaves* on first year's shoots, oblong lanceolate, up to 4 inches long, second year's shoots leafless and flower bearing. *Racemes* lateral and terminal, many flowered, *bracts* small, *flowers* greenish-yellow, about $\frac{3}{4}$ inches long, *sepals* oblong, *petals* obvate, *spur* short, incurved, *lip* flat, side lobes moderately small, rounded, midlobe subquadrate, disk with a channelled ridge between the lateral lobes and with a hairy surface as far as the centre of the midlobe.

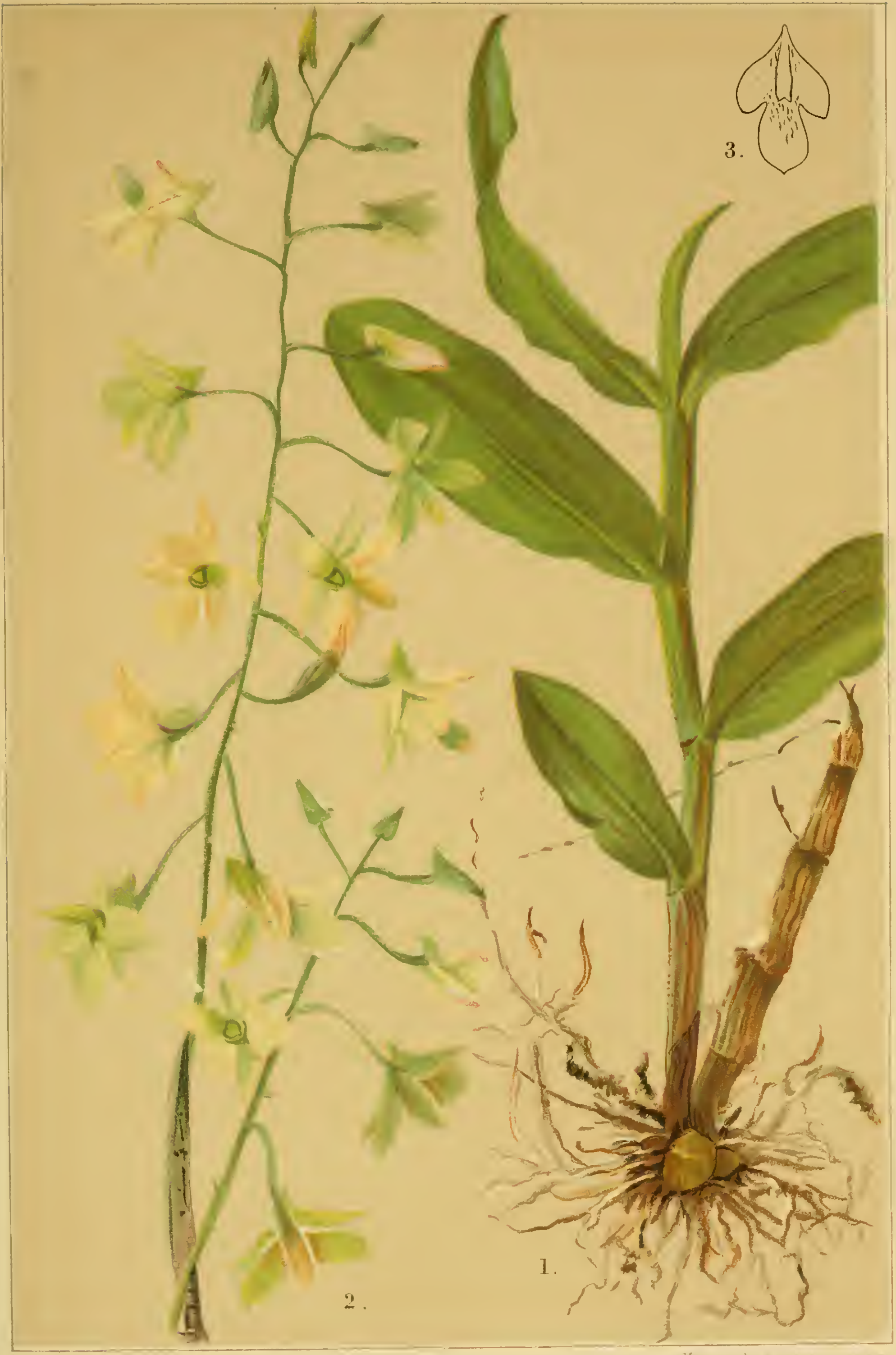
Distribution.—Throughout the Ghats and the Konkan towards the south. Flowers appear in the cold season.

Plate 1. Fig. 1. Plant with leaves. Fig. 2. Upper part of flowering plant. Fig. 3. Lip enlarged.

[1. *Dendrobium chlorops, Lindl.*—

This plant has no native name in the Konkans. But on the Malabar Coast it is called Mârâvar. Neither Graham nor Nimmo seem to have found it in the Konkans, but Dalzell and Gibson describe it in their Bombay Flora. Mr. H. M. Birdwood has found it at Matheran. In the Thana District I have found it growing on branches of mango trees in the rainy season. Dalzell and Gibson say that the plant flowers in the cold weather, they give its synonym thus :—" *D. Heymanum, Wight Ic.* 909 ? " The query is Dalzell and Gibson's own. In a manuscript pencil note General Julius Hobson, in his interleaved copy of Dalzell and Gibson's Bombay Flora now in my possession, says in reply to the query :—" No, I think not. " General Hobson's remark is made from personal observation. He, as Major Hobson, was for a long time employed in the Survey Department in the Bombay Presidency in the early sixties of the last century. He was a keen botanist, and a careful collector and preserver of plants. His sketches of plants or parts of plants wherever made in his interleaved copy of D. and G.'s Bombay Flora are accurate, original and from nature. Dr. Dalgado says that it is very common in Savantwadi and Goa. It grows in cool places.

Williams describes it as a " very pretty flowering species producing pale nankin flowers having the base of the lip of a bright pea-green. The flowers last a considerable time in bloom." (Orchid-Growers' Manual, p. 329. Ed. seventh, 1894.) I may add that the meaning of *Nankin colour* or *Nankeen colour* in dyeing, is the shade of buff obtained from iron salts. As seen by me, in Thana, the petals of the flowers are sometimes cream-coloured. When fresh they have an evanescent slight smell of the English Primrose of Beaconsfield fame.



DENDROBIUM CHLOROPS, Lindl.

Fig. 1. Plant with leaves. Fig. 2. Upper part of flowering plant.
Fig. 3. Lip (enlarged).

Nairne notes thus:—"Flowers variable in size and colour (Hooker). I venture to say that Hooker's description, as given at page 719, Vol. V., Flora Br. Ind., is not sufficient for the purpose of identifying the plant. This probably was due to Sir Joseph Hooker having written his description from a dry Herbarium specimen or specimens, and not direct from nature. Rheede attributes medicinal properties to this plant which are worth quoting, though I have no personal experience of them. They are translated from Latin for the reader as follows:—'The entire plant, recently gathered, chiefly its juice, when given internally, cures all kinds of stomach-aches and colic, excites bile and acts as a laxative to the intestines.'" This plant was first identified for me by Mr. M. C. Turner of Bombay. The plate is from my collection. K. R. K.]

(*To be continued.*)

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

By L. C. H. Young, B.A., F.E.S., F.Z.S.

With Plate 1.

Part I.—Introductory.

The object of this series of articles on the common butterflies of India is to encourage those who have a genuine desire to collect insects, but are deterred from doing so either from the want of any handbook from which they could name their captures, or from their inability to understand the scientific technicalities in the literature to which they already have access.

It is hoped that having once named their early captures they will be encouraged to go on collecting on a larger scale.

At the same time, as the mere identification of specimens from coloured plates would leave a collector practically as ignorant as when he started, and it being moreover impossible to illustrate all the species he would be likely to meet even in one season, it is advisable to describe simply the general structure of butterflies on the variations of which all classification, arrangement, and ultimately, nomenclature is based.

A butterfly is divided structurally into three parts : the Head, Thorax and Abdomen.

The Head supports the following paired organs :—(1) the eyes, (2) the antennæ or feelers, rising between them, consisting of a great number of rings or joints which are more or less flattened, swollen or grooved towards the tip, so as to form a club. The variations in the character of the club, as well as in the actual length of the antennæ as compared with that of the forewing, are often of considerable importance.

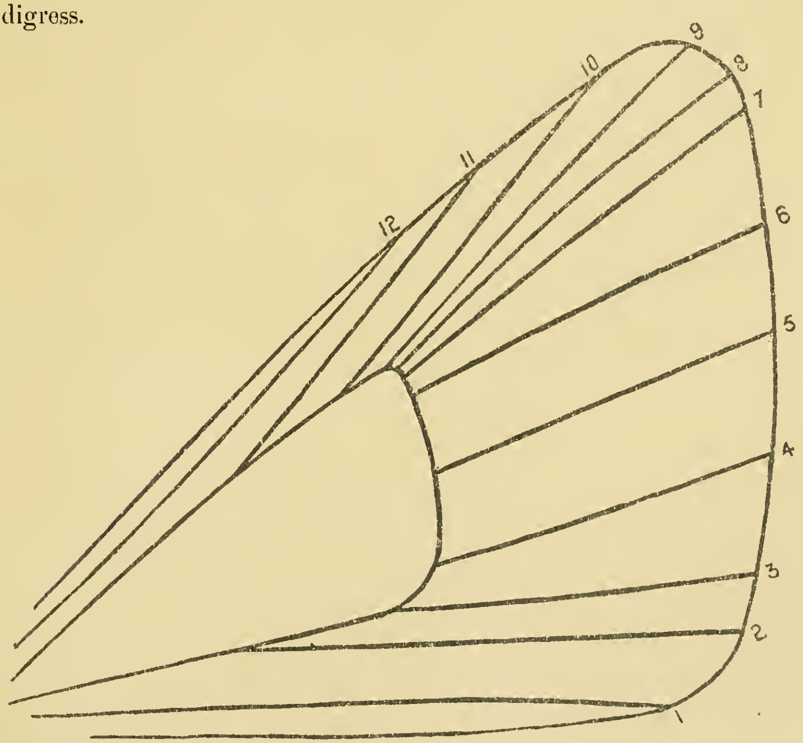
Below and in front of these are the mouth organs which consist of (3) the labial palpi ; projecting organs of 3 joints generally thickly scaled and varying considerably in shape. Their principal function is apparently merely to protect (4) the proboscis or trunk which is really a modification of a pair of organs—the maxillæ—and can easily be divided with the point of a needle. The front of the head above the palpi is known as the frons.

The Thorax consists of three segments, which, however, are generally so thickly scaled that they have the appearance of one. The first segment or prothorax supports the anterior or front pair of legs. The second, the mesothorax, supports the middle pair of legs and the forewings. The third, or metathorax, the posterior legs and the hindwings.

A butterfly's leg consists normally of 5 segments : (1) the coxa, a short joint attached to the thorax ; (2) the trochanter which is a small pivot connecting the coxa with (3) the femur or thigh ; (4) the tibia, which normally carries two pairs of spurs, one pair about the middle and the other at the apex where it joins (5) the tarsus. This is subdivided into 5 small joints and bears a pair of claws at the apex. The wings are triangular in shape, the upper side being known as the " costa, " the lower as the " dorsum" or inner margin, and the outer as the " termen " or outer margin.

They are interlaced with a number of nervures or veins whose variations are extremely important.

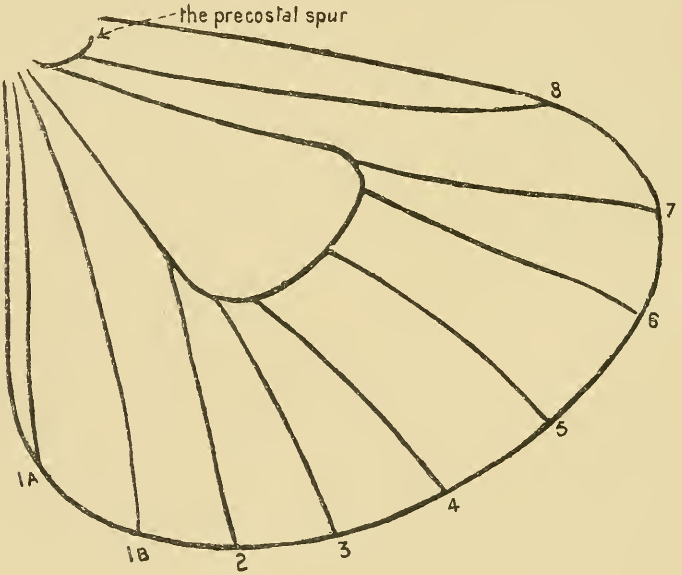
For simplicity each vein is known by a number, as will be seen from the figures below of the wings of *Ismene jaina*, which approximates very nearly to the type from which all the variations we shall speak of digress.



In the forewing there is a central more or less triangular cell, the sides of which are known as the upper, lower and outer margin (or transverse vein) respectively.

There is one vein rising free from the cell below it (No. 1) and one free above it (No. 12) and 10 veins numbered 2 to 11 rising out of the cell.

The hindwing is similar, except that there are only six veins rising out of the cell and consequently the upper one is numbered 8 instead of 12, and there are two free veins below the cell numbered 1a and 1b. At the base of vein 8 there is a short vein running to the costa known as the "precostal spur" which is sometimes forked and sometimes obsolete.



It will be as well to remember the technical terms for some of the commonest variations :

If 2 veins instead of rising independently have a common origin from the cell and branch apart later, they are said to be "stalked."

If 2 veins rise independently and after coalesce for a short distance and then separate again they are said to "anastomose." An extreme form of this structure is when they coalesce through their entire length and one vein disappears altogether ; or the process may be reversed and the veins tend to separate again until there is nothing but a small bar connecting them.

Often a vein becomes " abortive, " being traceable only as a fold in the wing.

The majority of butterflies are so large that the structure of the wing can be easily seen even without a lens, but in the case of others a drop of benzine applied with a camel's hair brush on the underside will make all the veins stand out clearly at once while leaving the wing quite uninjured as soon as it is dry.

The third section of the butterfly is the *abdomen*, to which are attached the genital appendages, but as the structure of these is of very little importance for our purpose they need not be described here.

Butterflies are classified under seven families, the distinctions between which as set forth in the following table should be easily understood from the foregoing :—

A. Wings with all the veins present and rising independently from each other .... 7 *Hesperiadæ.*
AA. Forewing with one or more veins absent or stalked.
  B. Anterior legs fully developed in both sexes.
    C. Hindwings. 1. a. absent .... 6 *Papilionidæ.*
    CC. ,, 1. a. present .... 5 *Pieridæ.*
  BB. Anterior legs rudimentary in both sexes useless for walking.
    D. Forewings vein 12 greatly swollen at base .... 2 *Satyridæ.*
    DD. Forewings veins normal .... 1 *Nymphalidæ.*
  BBB. Anterior legs of ♂ only aborted .... 3 *Erycinidæ.*
  BBBB. ,, ,, ,, abbreviated or with one or both claws absent ...... 4 *Lycænidæ.*

FAMILY I. NYMPHALIDÆ.

PART II.—DESCRIPTIVE.

The species we are illustrating in this family belong to fifteen different genera which may be separated by the characters given in the following table :—

A. Hindwings with cell closed, veins 3 and 4 separate.
  B. Forewings veins 9 and 10 stalked .... 11 *Telchinia.*
  BB. ,, ,, ,, separate or from a point only..........

C. Fw. vein 5 from the middle of the transverse vein.
D. Præcostal nerve bent forwards, simple.
E. Anterior legs clothed with long hair-like scales.................................... 12 *Limnas.*
EE. Anterior legs clothed with short appressed scales generally fringed with thinly scattered long hairs ...... 13 *Danais.*
DD. Præcostal nerve bent backwards, bifurcate ..... 14 *Euplœa.*
CC. Fw. vein 5 approximated to 6 at base .... 15 *Melanitis.*
AA. Hindwings veins 3 and 4 from a point or stalked, or cell open (*i.e.* with the transverse vein rudimentary).
B^1. Club of antennæ short, broad, abrupt.
C^1. Forewings veins 3 and 4 stalked or from a point 2 *Junonia.*
CC^1. „ „ 3 and 4 separate.
D^1. Eyes smooth.
E. Fw. veins 2, 3 and 4 equidistant at base .... 1 *Argynnis.*
EE. Fw. space between 3 and 4 less than half than between 2 and 3. .... 3 *Hypolimnas.*
DD^1. Eyes hairy... 4 *Vanessa.*
BB^1. Club of antennæ long, gradual, often slight
C^2. Fw. veins 3 and 4 widely separate .... 8 *Charaxes.*
CC^2. Fw. 3 and 4 closely approximated at base or from a point, or cell open.
D^2. Fw. veins 5 and 6 nearly parallel.
E^1. Fw. veins 9 and 10 stalked ...... 9 *Cethosia.*
EE^2. Fw. veins 9 and 10 separate ... 10 *Kallima.*
DD^2. Fw. veins 5 and 6 more or less approximated at base
E^2. Fw. veins 9 and 10 stalked ... 5 *Cupha.*
EE^2. Fw. veins 9 and 10 separate.
F. Palpi as long as or longer than the head .... 6 *Cyrestis.*
FF. Palpi shorter than the head.............................. 7 *Apatura.*

Genus ARGYNNIS.

This is the first genus illustrated in this series and includes all those species familiarly known as Fritilleries.

It comprises a very large number of species which shew considerable structural variation, but they form such a distinct group all resembling each other so closely that the plan adopted by Colonel Bingham, of treating them all as one genus, is the most satisfactory, particularly for amateurs.

The genus is, properly speaking, a Palæarctic and Nearctic one, that is to say, its main distribution is throughout the northern hemisphere· There are about 16 species belonging to the Indian fauna, but all except two are confined to the Himalayas and the hills of Assam. The species we have figured, **A. hyperbius,** and the closely allied species **castetsi** are the only purely tropical forms in the genus.

Before describing these it would be as well to mention that there is a butterfly (**Cupha phalantha**) found all over India, which will be described in a later paper, which has all the typical fritillery markings and is certain to be treated as one by a collector fresh from home. As a matter of fact, however, it is structurally distinct and belongs to a different section of the family. The resemblance is very curious, as it cannot be explained by mimicry. One dare not use the word accidental in science, but the resemblance is as yet unaccounted for by any plausible theory.

Argynnis hyperbius, Johan. *Male.* Forewing bright orange yellow with the following black markings: four lineal spots in the cell, the two central ones sometimes joined above and below so as to form one kidney-shaped spot with a yellow centre. A lineal black spot at the end of the cell. Three spots below the cell, decreasing in size towards the base. Three quadrate spots beyond the cell, between the veins and a fourth beyond them between veins 6 and 7. A waved line of six round spots beyond these, the third and sixth the smallest. A submarginal row of longitudinal spots between the veins and a marginal row of more or less connected spots on the veins. Fringe or cilia between them whitish.

Hindwing usually slightly paler than the forewing. An irregular black spot in the cell, a small spot at the end of it, an irregular row of six lunulate spots beyond the cell between the veins and a row of five round spots beyond it. Marginal and submarginal spots as in the forewing, but increasing in size towards the anal angle, and suffused with bluish.

Underside.—Forewing with the basal two-thirds orange and the apical third pale ochreous. Spots as on the upperside except those in the apical third which are greenish olive-brown, the spaces between them silvery white. Hindwing pale ochreous suffused over the basal half with olive-brown with three irregular lines of silvery white spots more or less outlined with black; a fourth row of silvery spots beyond the olive area. Outer area of the wing with the black spots of the upperside represented by olive ones, sometimes with silvery centres.

Female.—Spots as in the male, but the ground colour much less bright and the apical third of the forewing suffused with bluish black. The spaces between the spots in this area whitish and forming a more or less continuous white subapical band.

Hindwing as in the male, but the marginal bluish suffusion more pronounced.

Underside as in the male, except for the presence of the white band as on the upperside of the forewing preceded by a bluish-black suffusion.

Distribution.—Ceylon, Malabar, the Himalayas, Assam, Burma.

Expanse $2\frac{3}{4}''$ and $3''$.

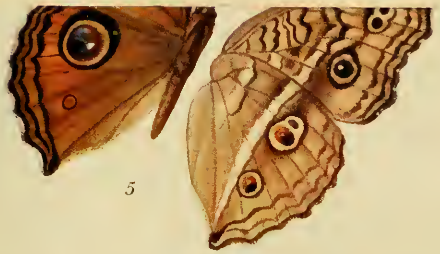
The species, **A. castetsi**, Ober, mentioned above appears to be confined to the Palni Hills and resembles **A. hyperbius** very closely in the male, but the wings are shorter and more rounded, and the coloration much brighter, particularly on the underside where the base of the forewings is pinkish and the olive-brown markings much greener.

The *female,* however, is very distinct from that sex of **A. hyperbius,** being similar to the male, but with the ground paler, the spots larger, and the basal two-thirds of both wings suffused with greenish.

There is a variety of *A. hyperbius* found in the Nilgiri Hills which is apparently intermediate between the two species.

Genus JUNONIA.

The Genus Junonia includes six Indian species, five of which are common all over the country and are figured on our plate. The sixth, **J. atlites,** L., though it does not occur in the Konkan or nearer Bombay than Goa is yet found in all the other forest regions of the Peninsula. The species although differing very much in colour are all so obviously allied in general form and habit that the beginner should have no difficulty in grouping them together at once. Messrs. Aitken, Bell, and Davidson wrote of them in the Journal some years ago: "We have reared all our Junonias and cannot ordinarily tell the larvæ and pupæ from one another. . . . They all feed on acanthads."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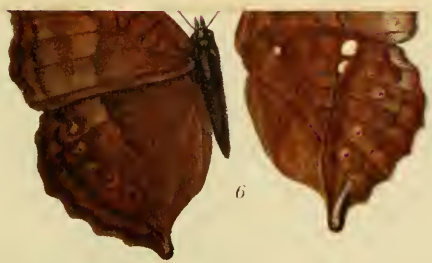
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THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

ce Knight, del. Hentschel-Colourtype.

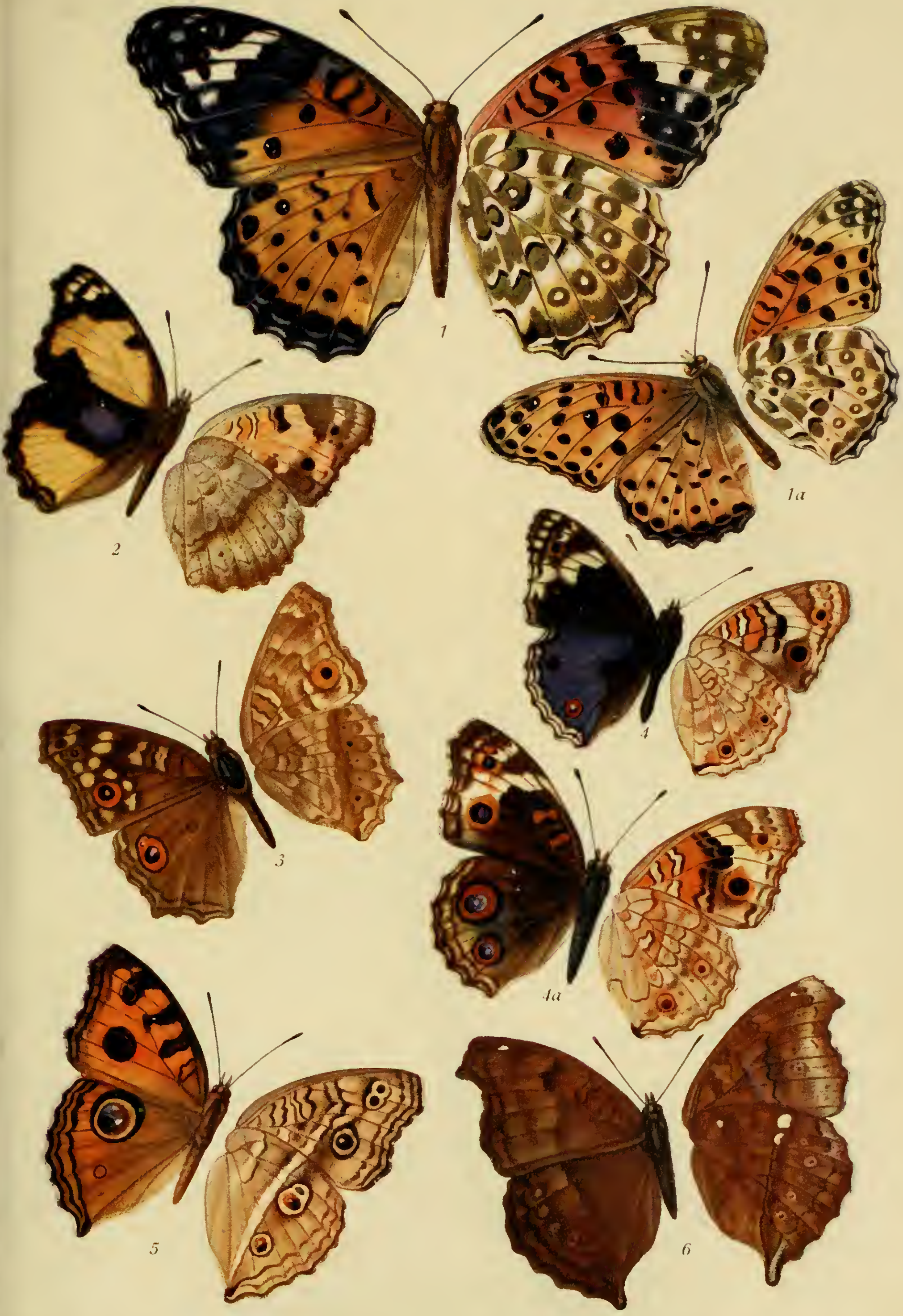
THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

EXPLANATION OF PLATE A (1).

Fig. 1. *Argynnis hyperbius*, ♀
1*a*. *do.* ♂
2. *Junonia hierta*, ♂
3. *Junonia lemonias.*
4. *Junonia orithya*, ♂
4*a*. *do.* ♀
5. *Junonia almana.*
6. *Junonia iphita.*

J. atlites, L., though it does not occur in the Konkan or nearer Bombay than Goa is yet found in all the other forest regions of the Peninsula. The species although differing very much in colour are all so obviously allied in general form and habit that the beginner should have no difficulty in grouping them together at once. Messrs. Aitken, Bell, and Davidson wrote of them in the Journal some years ago: "We have reared all our Junonias and cannot ordinarily tell the larvæ and pupæ from one another. . . . They all feed on acanthads."

PLATE A.



THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

Horace Knight, del.

Hentschel-Colourtype.

The outline of the wings is more or less angulate, generally sharply so below the apex of the forewing and at the anal angle of the hindwings. The extent to which the angular points are produced, appears to vary seasonably. The markings of several of the species vary more or less with the seasons.

J. hierta, Fb. Bright chrome yellow. *Forewing.*—Costal margin black, generally with a projection or tooth opposite the end of the cell, though this is sometmes hardly traceable. The apical area blackish, enclosing a creamy-white spot and with from 3 to 5 whitish submarginal spots between veins towards apex. A black spot between veins 2 and 3 near margin generally joined to a broad black band along the inner margin. A marginal blackish line, cilia whitish between the veins.

Hindwing with the basal and costal area black, this area varying one-third to a half of the wing and containing a large blue patch. A broad black marginal band cilia as in the forewing.

Underside forewing pale-yellow, the inner margin and apical area greyish, some faint brownish streaks in the cell, sometimes joined to enclose grey spots, a brown streak at the end of the cell. The cream white subapical spot of the upperside just traceable and a brown spot below it. The spot between veins 2 and 3, as on the upperside, prominent. Hindwings grey suffused with yellowish towards outer margin and crossed by several indistinct brown lines. A brownish band from the costa to vein 3 beyond the cell.

Female similar to the male, but with two or three blackish lines in the cell and the projection from the costal band expanding to form a broad black spot at the end of the cell. A blue-centred spot immediately below the creamy subapical spot, and the spot between veins 2 and 3 with a blue centre. Hindwing generally with one or two black spots in the yellow area. Underside as in the male.

Distribution.—Throughout India and Ceylon.

Expanse $2\frac{1}{4}$."

J. orithya, L. *Male.* Forewing with the basal two-thirds of the wing black, traces of bluish in the cell and a bluish patch at the anal angle. A black blue-centred spot in an orange ring above it. Apical patch brownish black bounded on the inner side by a broad irregular yellowish white band and containing three conjoined spots, the two upper ones whitish, the lower one orange black-centred, sometimes traces of a fourth orange spot. A submarginal series of whitish spots, margin blackish.

Hindwing.—Blue, a black triangular patch on the inner margin reaching to the middle of the cell and two orange blue centred spots with black margins near the outer margin. A marginal and two submarginal black lines, the space between them whitish.

Underside dirty ochreous white. A yellow dark outlined spot in the cell and another at the end of the cell reaching to vein 2, two black lines beyond it, the outer one expanding into spots about the middle. The blackish apical area of the upperside traceable and the two eyelike spots black, yellow-ringed. Hindwing brownish white crossed by several irregular brown lines, the eyelike spots of the upper-side just traceable.

The *female* differs from the male in being much less blue, the basal area of the hindwings suffused with blackish, the eyelike spots of both wings larger and more prominent, and in having an orange spot in the cell of the forewing and another at the end of it.

Distribution.—Throughout India and Ceylon.

Expanse 2⅛″—2½.″

J. lemonias, L. Male and female dark brown, the basal area paler. Forewing with 3 darker lines in the cell and one at the end of it. A pale-yellowish spot between the two middle ones, and two conjoined spots beyond them. An irregular postmedial series of yellow spots curving round a large eyelike spot, (black blue-centred in an orange ring) towards the anal angle ; another series of pale yellowish spots beyond it and a submarginal yellowish line more or less broken into spots. Sometimes there is a second smaller ocellate subapical spot, but this is more often absent or only faintly traceable.

Hindwing.—Brown dusted with paler, a prominent ocellate spot as on the forewing between veins 6 and 7 beyond the cell ; two submarginal and a marginal dark brown line.

Underside pale yellowish, the costal half of the forewing and the whole of the hindwing suffused with brownish or in the dry season with pinkish brown. Both wings traversed by numerous irregular brown lines and on the forewings the ocellate spot of the upperside showing as a prominent black yellow-ringed spot.

Distribution.—Throughout India and Ceylon.

Expanse 2⅛″—2½.″

J. almana, L. Male and female. Forewing bright orange-yellow. Two irregular brown lines in the cell and a black pale centred spot at end of the cell, a brownish streak on the veins beyond and parallel to it. Two ocellate spots in the postmedial area between veins 2 and 3 and 5 and 6, consisting of a pinkish black white-centred spot in a whitish black-margined ring; the upper spot much the smallest, sometimes traces of a black spot immediately above it. Two submarginal and a marginal brown line, the spaces between them suffused with brownish.

Hindwing bright orange-yellow with the marginal lines as in the forewing. A large ocellate spot beyond the cell reaching from near the costa to below vein 5; the centre pinkish dusted with grey and containing one black and two white suffused patches, the inner ring pale-yellowish and the outer black.

Underside. Dry-season form.—Uniform pale brown. A straight brown line across the disc of the hindwing and traces of submarginal lines.

Wet-season form.—Pale ochreous, marginal brown lines, ocellate spots, and brown spots in and beyond the cell of the upperside prominent. The postmedial brown streak of the forewing continued to the inner margin. Hindwing with a straight narrow whitish band across the centre of the wing and an additional ocellate spot between veins 2 and 3.

Distribution.—Throughout India and Ceylon.

Expanse 2⅛″ at 2½.″

Junonia iphita, Br. Glossy brown.—Forewing with two darker lines in the cell and two at the end of it, an irregularly dark-brown postmedial line, the space beyond it paler; a darker subapical suffusion preceding faint traces of a row of brown spots; submarginal and marginal brown lines. The cilia generally irregularly blotched with white.

Hindwing with the outer half paler, traces of a row of postmedial spots and with marginal and submarginal brown lines.

Underside generally a much richer brown, the lines of the upperside shewn as bands nearly chocolate in colour; the postmedial spots more prominent, ringed with pale centres and sometimes particularly towards the costa of the hindwing, outlined with the pale-yellow patches.

This is by far the dingiest of the genus and it has a slower flopping kind of flight, but when seen close its glossy velvetty appearance is by no means unhandsome.

Distribution.—Throughout India and Ceylon.

Expanse 2¼″ at 3.″

The other species of this genus, **J. atlites,** L., which we have not figured, is a pale-grey insect, both wings crossed by numerous brown lines and having a postmedial series of spots, which vary much in size and may number seven on the forewing and six on the hindwing, being reddish-orange with black centres in white dark-edged rings. The markings on the underside are similar to the upper.

(*To be continued.*)

DESCRIPTIONS OF INDIAN MICRO-LEPIDOPTERA.

By E. Meyrick, B.A., F.R.S., F.Z.S.

I.

In this and successive papers I propose to endeavour to work out the Indian *Micro-Lepidoptera* (including under this head those of Burma and Ceylon), a task of great interest and probably also of great magnitude. For material I shall be wholly dependent on others, since there is no likelihood of my being able to visit the region personally at present, and I have already received much kind help and promise of more. I venture, however, to appeal to all collectors to assist in this matter : very little is known at present, and even the commonest species will be welcomed, to ascertain geographical range and variation. Full information as to localities, elevation, dates, and larval habits is also desired. If collectors will number the species sent in rotation, proceeding to higher numbers for successive consignments, and retaining specimens with corresponding numbers, I will send them the identifications according to these numbers. All types of species described will eventually be deposited in the collection of the British Museum ; but I hope also to be able to send duplicates of many species to Mr. E. E. Green, Government Entomologist of Ceylon, and Mr. L. C. H. Young, Entomological Curator at the Bombay Museum, to form reference collections which can be consulted on the spot.

It is very desirable that specimens should be in good condition ; poor specimens may be identified if the species is already known, but could not be described. In particular, care should be taken to prevent their becoming mouldy, which, I am aware, is difficult in the tropics ; but mould will not attack insects in boxes if a small piece of sponge is pinned in one corner (so as not to come in contact with the box itself) and some carbolic acid dropped on the sponge ; the vapour will not only keep off mould, but insect pests of all descriptions. Mould on the head of small insects makes the structure unrecognisable, and, in general, cannot be removed.

It is impossible to insist too strongly on the necessity for proper packing ; it is very disappointing to all concerned when valuable specimens are destroyed in transit, whilst with due care this need never happen. I recommend that the following instructions should be strictly carried out. The insect-box should be small and light, no strength being required, and the cork should be good ; the specimens placed as close together as possible, all pins firmly fixed, and if naphthaline or other preservative is included, it should be wrapped in muslin, and this very firmly pinned. A piece of loose cotton wool may be pinned in one corner to catch stray abdomens if detached. The insect-box should then be packed in a larger box of sufficient size to allow of at least one inch of packing all round, and at top and bottom ; this packing should be either cotton wool or tightly crumpled paper, the latter material being unsurpassed for cheapness and efficiency. The outer case must be strong enough to resist moderate pressure, but any light wooden box will serve, or a biscuit-tin does very well. The address should not be entrusted to a tied label, as these are frequently dragged off in transit, but gummed on the outer case. Insects thus packed were sent me by Captain (now Lt.-Col.) Manders from the Shan States, travelling hundreds of miles by pack-mule over mountain ranges and unbridged torrents before making the voyage to England, and suffered absolutely no damage. All consignments should be addressed to me at Thornhanger, Marlborough, Wilts.

All specimens must be pinned, not sent in papers ; if possible, they should be set, as they do not relax so well as larger insects, and this applies especially to the more minute species which can hardly be set except when fresh. Fine pins of only moderate length should be used ; for average Micros it suffices if there is about half-an-inch of pin below the insect, and enough above to grasp with the forceps.

As the basis of the following descriptions I have assumed the classification, terminology, systematic characters, &c., given in my "Handbook of British Lepidoptera." As the work proceeds, I will give such dichotomous tabulations of the genera and species from time to time as may seem necessary. Meanwhile, I shall be glad to explain to correspondents any difficulties that they find in identification of species.

For the material of the present paper I am indebted to Mr. E. E. Green, Government Entomologist of Ceylon ; Mr. J. Pole, of Maskeliya, Ceylon ; Lt.-Col. N. Manders, R.A.M.C. ; and Mr. H. Maxwell-Lefroy, Government Entomologist of India. The name of the collector is recorded in the case of each species.

PTEROPHORIDÆ.

Oxyptilus zanclistes n. sp.

♂♀. 16 mm. Head and thorax ochreous-whitish, irrorated with fuscous. Palpi white, second and terminal joints with oblique dark fuscous bars. Antennæ white, lined with blackish. Abdomen whitish-ochreous, mixed with fuscous. Segments 1—3 with wedge-shaped dark fuscous dorsal marks, 4—6 wholly dark fuscous on dorsum. Forewing with segments extremely narrow, apex of second segment forming a very long slender sickle-shaped projection; fuscous, finely irrorated with whitish-ochreous; a cloudy dark fuscous discal dot at $\frac{1}{3}$; an ochreous-whitish costal spot on middle of first segment; cilia, whitish-ochreous, dark fuscous spots in costal cilia before and beyond pale spot, two others posteriorly, and one at apex, lower cilia of first segment and upper of second with scattered dark fuscous scales, dorsal cilia with grey prætornal patch, and four slight scale-projections of two or three dark fuscous scales each, first mixed with whitish scales. Hindwings dark fuscous, third segment ochreous-whitish posteriorly, irrorated with dark fuscous; cilia of first two segments fuscous with slight purplish tinge, of third segment whitish-ochreous, on upper margin irregularly strewn with black scales and with a loose tuft of black scales at $\frac{2}{3}$, on dorsum with a rather broad patch of black scales at $\frac{2}{3}$ and a small tuft at apex.

Two specimens, Fort Stedman, Burma (Manders). Differs from other described species by the especially long and slender apical projection of the second segment of forewings.

Oxyptilus causodes n. sp.

♂♀. 20—22mm. Head, thorax, and abdomen dark reddish-fuscous, face without tuft. Palpi long, slender. Forewings with segments narrow; dark reddish-fuscous, slightly sprinkled with whitish-grey, especially on first segment; an ochreous-whitish costal dot or small spot at middle of first segment, and a slender ochreous-whitish bar near its apex; cilia fuscous, with numerous scattered blackish scales, forming a bar at lower angle of tip of first segment, rounded dark fuscous black-edged spots at tip of second and tornus, and two undefined projections on its dorsum. Hindwings with segments linear; dark fuscous; cilia fuscous, on third segment mixed with black scales at base on both margins, with a large triangular black scale-tooth on lower margin at $\frac{3}{4}$, and a small one beneath apex.

Nine specimens, Peradeniya, Ceylon, in August and October (Green). Larva feeds in fleshy fruits of *Dillenia retusa*, in August; when about to pupate, it leaves the fruit and attaches itself to any neighbouring support (Green).

Alucita L.

I follow Lord Walsingham's most recently expressed views in adopting the name *Alucita* for the genus standing in my Handbook as *Pterophorus* and the name *Pterophorus* for the genus there called *Alucita*.

Alucita sesamitis n. sp.

♂. 21 mm. Head, palpi, antennæ, thorax, and abdomen ochreous-whitish. Legs white, anterior and middle pair with a blackish line. Forewings with segments moderately narrow; ochreous-whitish; a fuscous discal dot at $\frac{1}{3}$; a small fuscous spot at base of upper margin of second segment; first segment with a blackish dot on costa beyond its middle, and another on its lower margin before apex; second segment with a blackish dot in middle of its lower margin, another beyond this, and a third at apex ; cilia whitish, towards tornus tinged with greyish-ochreous towards tips. Hindwings grey, third segment becoming ochreous-whitish towards base ; cilia whitish-grey, on dorsum of third segment becoming whitish towards base.

One specimen, Koni, Burma, in September (Manders).

ORNEODIDÆ.

Orneodes thapsina n. sp.

♂. 21 mm. Head whitish-ochreous, crown ochreous-yellow. Palpi and antennæ ochreous-whitish. Thorax ochreous-orange, partially sprinkled with fuscous. Abdomen ochreous-orange, segmental margins white. Legs whitish, anterior femora and tibiæ dark fuscous above. Forewings orange-ochreous, towards base partially suffused with fuscous, posterior $\frac{2}{3}$ crossed by four irregular whitish lines, partially obscurely edged with a fuscous tinge ; tips of segments pale or whitish, with a minute dark fuscous terminal dot ; cilia alternately whitish-ochreous and whitish. Hindwings whitish ; segments 1—5 with six, segment 6 with three ochreous bars irregularly edged with dark fuscous irroration ; cilia as in forewings.

Two specimens, Maskeliya, Ceylon, in February (Pole). Only comparable in general colouring with the Australian *O. xanthodes*, from which, however, it is quite distinct.

Orneodes ischalea n. sp.

♂. 13 mm. Head white, back of crown mixed with fuscous. Palpi white, externally fuscous-tinged. Antennæ whitish. Thorax whitish, mixed with fuscous. Abdomen whitish, irrorated with fuscous, with a clear white trapezoidal dorsal patch before middle, and a spot beyond middle. Legs white, anterior femora and tibiæ infuscated above. Forewings and hindwings whitish-ochreous, crossed by six white irregular lines edged with fuscous irroration, sixth terminal; base of forewing mixed with dark fuscous, costa spotted alternately with white and dark fuscous ; cilia alternately whitish-ochreous and whitish.

One specimen, Pundalu-oya, Ceylon, in February (Green).

EPIBLEMIDÆ.

Platypeplus Wals.

Antennæ in ♂ simple or shortly fasciculate-ciliated. Palpi porrected or subascending. Thorax with posterior crest. Posterior tibiæ broadly dilated with long dense rough scales, forming a brush on inner side, in ♂ with one or more expansible hair pencils above. Forewings in ♂ without costal fold, termen straight or slightly rounded, with dorsal scale-projection at $\frac{1}{3}$, 7 and 8 separate. Hindwings with 3 and 4 connate, 5 approximated to 4, 6 and 7 approximated towards base, in ♂ sometimes with subdorsal groove.

Closely allied to *Eucosma*, from which it differs essentially by the brush-like posterior tibiæ. This character is not mentioned at all by Lord Walsingham, but his genus was based on the single species *aprobola* Meyr., which shows the structure clearly. I have also an undescribed Australian species, and now add eight from Ceylon, so that the genus will doubtless prove very extensive.

Platypeplus hedrœa n. sp.

♂. 14—15 mm. Head ochreous-fuscous, purplish-tinged. Palpi dark fuscous. Antennæ fuscous. Thorax ferruginous-brown, suffused with purplish. Abdomen grey, apex whitish. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen straight, little oblique, rounded beneath; deep ferruginous, posteriorly brown-reddish on veins and suffused with blackish grey between them; an obtuse-triangular white costal patch, extending along costa from before $\frac{1}{3}$ to $\frac{3}{4}$, and reaching $\frac{1}{3}$ across wing, on costa strigulated with black, beneath which is a slight grey or ochreous suffusion; ocellus containing three or four longitudinal blackish bars, its posterior margin leaden; a fine blackish line from costa before apex to termen below middle; extreme apex orange; cilia ferruginous, partly barred with dark grey. Hindwings somewhat distorted and roughened with scales on dorsal $\frac{2}{3}$ of posterior half; grey thinly scaled towards base, darker towards tornus; cilia whitish grey, with darker subbasal line.

Two specimens, Kandy, Ceylon, in August and September (Green). Easily known by the white costal patch.

Platypeplus harmonica n. sp.

♂. 18 mm. Head and palpi blackish grey, marked with white. Antennæ dark grey. Thorax dark grey mixed with white. Abdomen dark fuscous, anal tuft whitish. Posterior tibiæ with long hair pencil from base above, basal joint of posterior tarsi with fringe of dense projecting scales above. Forewings elongate-triangular, costa posteriorly moderately arched, apex obtuse, termen somewhat rounded, little oblique; deep brown-red; basal half mixed with olive-green and blackish and suffusedly strigulated with white, with small scattered tufts of raised white scales, limited by an olive-green line; terminal half with pairs of white costal strigulæ; a small orange discal spot at $\frac{2}{3}$, preceded by a blackish suffusion; a pale purplish transverse shade beyond this, and a double pale ochreous subterminal stria, mixed with white broken beneath apex; between these some small grey spots, mixed with blue-whitish; cilia brown-reddish, barred with grey and white, towards tornus ochreous-yellow, and with a small orange spot at apex. Hindwings with subdorsal groove; dark fuscous, lighter towards base; cilia whitish with grey basal line.

One specimen, Peradeniya, in August (Green).

Platypeplus erotias n. sp.

♂ ♀. 13—16 mm. Head, palpi, and thorax ferruginous-brown, mixed with blackish. Antennæ brown. Abdomen fuscous. Forewings rather short-triangular, costa gently arched, apex obtuse, termen nearly straight, little oblique, rounded beneath; brown, more or less suffused with light rosy-crimson especially on margins, strigulated with dark fuscous, and strewn with spots of raised leaden scales, some of which are sometimes tipped with white; a small irregular whitish-ochreous spot in disc at $\frac{2}{3}$; cilia dark grey, basal half barred with rosy-crimson. Hindwings dark fuscous, lighter towards base; cilia grey, with darker subbasal line; in ♂ beneath with shallow subdorsal groove, and scales somewhat raised towards tornus, dorsal cilia thickened and curled towards tornus.

Five specimens, Maskeliya, Yatiyantota, and Peradeniya, Ceylon, in February, March, July, September, and November (Green, Pole).

Platypeplus phyllochlora n. sp.

♂. 15—17 mm. Head, palpi, and thorax dull green. Antennæ grey. Abdomen dark grey, with long lateral hair pencils on each side from near base. Brush of posterior tibiæ black on inner side. Forewings rather elongate, posteriorly dilated, costa gently arched, apex obtuse, termen nearly straight, hardly oblique, rounded beneath; rather light green; costa strigulated with black and whitish; basal third more or less strigulated with blackish; central fascia deeper green, more or less mixed with black, narrowest on costa, anterior edge undefined, posterior well marked, somewhat irregular, partially edged with white; a dark fuscous blotch, angular and edged with white above, roundish beneath, before middle of termen, between this and central fascia a short curved transverse dark fuscous mark; suffused white strigæ above this, connecting with costal strigulæ; tornal space more or less sprinkled with blackish and whitish; cilia dark grey, with two or three whitish ochreous bars beneath apex, towards tornus whitish. Hindwings with subdorsal groove and hair pencil; dark fuscous; cilia grey, with darker subbasal shade.

Three specimens, Peradeniya, Kandy, and Haragam, Ceylon, in July and August (Green).

Platypeplus creserias n. sp.

♂. 17 mm. Head and thorax fuscous, mixed with whitish ochreous. Palpi ochreous white, dark fuscous, above except towards apex. Antennæ pale fuscous. Abdomen fuscous, anal tuft ochreous-whitish. Forewings elongate-triangular, costa rather strongly arched, apex obtuse, termen straight, little oblique, rounded beneath; fuscous, densely and suffusedly strigulated throughout with whitish-ochreous, with some scattered dark olive-green scales; costa dark fuscous, with pairs of ochreous-whitish strigulæ terminated by short leaden streaks, beneath costa some reddish-ochreous suffusion; basal patch indicated on dorsal $\frac{2}{5}$ by dark fuscous intermixture, outer edge bent in middle; a small brown spot on middle of costa; a triangular darker fuscous prætornal spot, sprinkled with ochreous-whitish; a triangular pinkish fuscous apical patch, streaked with dark olive-green; cilia grey, mixed with ferruginous and dark fuscous, above tornus with a patch of ochreous-whitish suffusion. Hindwings rather dark fuscous; cilia whitish-fuscous, with darker subbasal line.

One specimen, Haragam, Ceylon, in July (Green).

Platypeplus threnodes n. sp.

♂. 28 mm. Head, palpi, and thorax dark ashy-fuscous, palpi with ochreous spots beneath apex of second and on terminal joint. Antennæ grey. Abdomen rather dark fuscous, apex of anal tuft whitish. Forewings elongate, posteriorly rather dilated, costa moderately arched apex rounded, termen almost straight, little oblique, rounded beneath; blackish-fuscous, closely and suffusedly strigulated with shining purplish-leaden, less so towards costa; a small roundish blackish spot in disc at $\frac{2}{3}$, and another above tornus; cilia purplish-leaden. Hindwings rather dark fuscous; cilia light grey, with darker subbasal line.

One specimen, Kandy, Ceylon, in July (Green).

Platypeplus hemiopta n. sp.

♂. 28 mm. Head, palpi, antennæ, and thorax light-brown. Abdomen fuscous, anal tuft whitish. Forewings elongate, posteriorly dilated costa, moderately arched, apex rounded, termen slightly rounded, little oblique; ferruginous-brown, suffusedly strigulated with purplish-leaden, costal half pale yellow-ochreous strigulated with prismatic whitish-ochreous, costa strigulated with dark fuscous, and on anterior half suffused with ferruginous-brown; some scattered black strigulæ on dorsal half, and an irregular black transverse mark above tornus; a dark fuscous suffusion towards termen beneath apex, concave beneath; cilia brown mixed with leaden, with a pale ochreous apical patch. Hindwings rather dark fuscous, with a small flap of white scales beneath costal area before middle; cilia light grey, with darker subbasal line.

One specimen, Peradeniya, Ceylon, in September (Green).

Platypeplus rhynchias n. sp.

♂ ♀. 24-29 mm. Head, antennæ, and thorax brown, face dark fuscous. Palpi brown mixed with dark fuscous. Abdomen whitish-fuscous mixed with dark fuscous. Forewings elongate-triangular, costa slightly arched, apex rounded, termen nearly straight, little oblique rounded beneath; ferruginous-brown, strigulated and more or less suffused with purplish-fuscous, except towards base; costa strigulated with dark fuscous; a small irregular triangular blackish spot above tornus; an irregular pale ochreous terminal fascia strigulated with darker, indented by a downwards-oblique acute projection of ground colour nearly or quite touching termen below middle, which is edged by two blackish strigæ, upper curved along margin of terminal fascia to apex, lower running towards costa at $\frac{4}{5}$, terminal fascia suffused upwards beneath this cilia; reddish-fuscous irrorated with whitish-ochreous, with two dark fuscous lines.

Hindwings rather dark-grey; cilia pale grey, with darker subbasal line.

Four specimens, Kandy and Yatiyantota, Ceylon, in March and November (Green).

Notocelia helota n. sp.

♂. 15 mm., ♀ 20-26 mm. Head, palpi, and thorax dark fuscous, sometimes mixed with brownish. Antennæ dark fuscous. Abdomen grey. Forewings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen nearly straight, rather oblique, rounded beneath; bent up and shortly oppressed to 2 near origin of latter; dark bronzy-fuscous, obscurely strigulated with leaden-grey; and ochreous-whitish discal dot at $\frac{3}{5}$; cilia bronzy-fuscous, with darker subbasal shade. Hindwings fuscous; cilia light fuscous, with darker subbasal shade.

Four specimens, Maskeliya and Badulla, Ceylon, in July and November (Green, Pole).

Lipoptycha ochropa n. sp.

♂. 8-9 mm. Head, antennæ, and thorax pale fuscous, face whitish-ochreous. Palpi ochreous-whitish. Abdomen fuscous. Forewings moderately elongate, posteriorly slightly dilated, costa gently arched, apex obtuse, termen slightly sinuate beneath apex, rather obliquely rounded, light fuscous, obscurely striated with dark fuscous, striæ rectangularly bent in middle, alternate dark striæ, purplish-leaden on costal half; costa strigulated with whitish; towards middle of dorsum four of the alternating striæ of ground colour becoming more whitish very obscurely indicate a dorsal blotch; four black dots before lower portion of termen; cilia whitish; fuscous, with dark fuscous subbasal line becoming sharper and blackish round apex. Hindwings rather dark fuscous; cilia whitish, with dark fuscous subbasal line.

Three specimens taken by myself at Kandy, Ceylon, in December.

Eucelis Hb.

I agree with Lord Walsingham that this name should be adopted for the genus standing in my Handbook as *Epinotia*.

Eucelis critica n. sp.

♂. 12-14 mm. Head and thorax grey, slightly ochreous-tinged, shoulders mixed with dark fuscous. Abdomen grey. Forewings elongate, costa gently arched, apex obtuse, termen slightly sinuate, little oblique, rounded beneath; olive-fuscous, posteriorly whitish-tinged, with scattered blackish-fuscous, strigulæ; costa strigulated throughout with blackish-fuscous, posteriorly with whitish interspaces; angulated outer edge of basal patch indicated by dark fuscous suffusion; central fascia suffused, dark fuscous, narrow on costa, broad and ill-defined in disc, obsolete towards dorsum; veins posteriorly lined with dark fuscous, and a longitudinal patch of dark fuscous suffusion between central fascia and termen above middle; a silvery-metallic transverse mark before middle of termen, preceded by four elongate black dots; apex blackish, edged beneath by a curved whitish strigula: cilia pale fuscous, more or less irrorated with whitish, towards apex suffusedly mixed with dark fuscous. Hindwings with 3 and 4 stalked; fuscous; cilia whitish-grey, with grey subbasal shade, dorsum with fringe of long blackish hairs.

Two specimens, Surat, Bombay, in October (Maxwell-Lefroy). Larva feeds in spun-up shoots of *Cajanus indicus* (Maxwell-Lefroy).

TORTRICIDÆ.

Eboda Walk.

Antennæ in ♂ moderately ciliated. Palpi moderate, porrected or ascending. Thorax without crest. Forewings without costal fold; 3 and 4 stalked, 7 to termen. Hindwings with 3 and 4 connate, 5 absent, 6 and 7 stalked.

Apparently related to *Oxygrapha*, but easily distinguished by the different neuration.

Eboda smaragdinana Walk.

(*Eboda smaragdinana* Walk. Cat. Suppl. 1805.)

♂♀. 14-18 mm. Head and thorax green. Palpi white, spotted with olive-green. Abdomen dark-grey. Forewings suboblong, costa abruptly arched and roughened with scales near base, broadly prominent and with a patch of rough projecting scales beyond middle, apex rounded-obtuse, termen slightly rounded, vertical ; deep emerald-green ; a round spot in middle of disc, a transverse spot from dorsum beyond middle nearly reaching it and sometimes a subcostal dot beyond middle mixed with ochreous and blackish raised scales, and edged with whitish ; a narrow dark grey terminal fascia continued round apex, anteriorly marked with blackish and edged with white, terminating just above tornus ; a blackish white-edged tornal dot ; cilia grey, base spotted with pale ochreous. Hindwings dark fuscous ; cilia fuscous, tips whitish.

Seven specimens, Kandy and Haragam, Ceylon, in March, August, and September (Green). Walker's type is from New Guinea ; his description is unrecognisable.

Oxygrapha Hb.

I think it best to follow Lord Walsingham in adopting this name for the genus standing as *Acalla* in my Handbook.

Oxygrapha sagmatias n. sp.

♂. 17-20 mm. Head and thorax fuscous. Abdomen pale fuscous or whitish-fuscous. Forewings moderately elongate, costa strongly and evenly arched throughout, apex obtuse, termen faintly sinuate, little oblique, rounded beneath ; fuscous, obscurely strigulated with darker, more or less mixed or sprinkled with ferruginous-brown, some very small scattered scale-tufts ; a curved ochreous-yellow ferruginous-mixed fascia-like blotch running from dorsum near base obliquely outwards to middle of disc, thence bent towards tornus and terminating at $\frac{2}{3}$, but this blotch is sometimes (var. 2) wholly obsolete ; a very small white spot before apex ; cilia dark fuscous, base and a median line paler. Hindwings pale fuscous or whitish-fuscous, suffused with darker posteriorly ; cilia whitish-fuscous, with dark fuscous subbasal line.

Five specimens, Maskeliya and Horton Plains, Ceylon, in February and March (Pole, Green).

Epagoge siderantha n. sp.

♂ ♀. 12-14 mm. Head and palpi pale brownish-ochreous or brownish, palpi in ♂ 3, in ♀ almost 4. Thorax brown, with large posterior crest tipped with dark fuscous. Abdomen whitish-fuscous, suffused with grey posteriorly, especially in ♀, anal tuft of ♂ whitish. Forewings elongate-triangular, costa moderately and evenly arched, apex obtuse, termen sinuate beneath apex, little oblique, rounded beneath ; ferruginous-brown ; numerous scattered small shining bluish-leaden-metallic spots, and a transverse series immediately before termen ; in ♂ a triangular pale yellow costal spot before middle, and a smaller one beyond middle ; in ♀ a triangular costal spot of orange suffusion beyond middle, and a large semi-circular deep orange dorsal blotch extending from $\frac{1}{3}$ almost to tornus, marked on dorsum with a pale yellow irregular outwardly oblique sometimes interrupted mark before middle, and a small pale yellow triangular spot beyond middle ; cilia pale ochreous-yellow, at tornus dark grey. Hindwings yellow-whitish, in ♂ with apex and some posterior and terminal strigulæ dark grey, in ♀ posteriorly rather widely suffused with dark grey, more strongly towards termen ; cilia ochreous-whitish, towards lower half of termen greyish, in ♀ with dark grey sub-basal shade.

Three specimens, Maskeliya, Ceylon, in February and March (Pole).

Cacœcia epicyrta, n. sp.

♂ 18-21 mm. ♀ 23 mm. Head and thorax reddish-fuscous, sometimes mixed with ferruginous. Palpi ferruginous. Abdomen fuscous, anal tuft brownish-ochreous. Forewings moderate, posteriorly dilated, costa in ♂ moderately arched anteriorly and sinuate before apex, in ♀ more strongly arched and sinuate, apex obtuse, prominent and in ♀ considerably produced, termen sinuate, beneath apex, not oblique but rather prominently bowed; 7 and 8 nearly approximated towards base ; costal fold of ♂ reaching from base to $\frac{2}{5}$ of costa, almost $\frac{1}{3}$ of wing in breadth, enclosing a pale ochreous-yellowish tuft ; ferruginous-ochreous, in ♀ strigulated with brown ; costal fold of ♂ suffused with dark fuscous ; an oblique triangular deep red-brown blotch from dorsum near base ; central fascia darker, in ♂ suffused with the purplish-fuscous and make above middle with deep red-brown, running from $\frac{2}{5}$ of costa to before tornus, narrowed on costa, edges irregular and ill-defined ; a dark red-brown elongate costal spot, reaching from middle to $\frac{5}{6}$; in ♂ a red-brown sub-apical spot, and an oblique ferruginous-brown mark from beneath costal spot, nearly reaching termen above tornus ; cilia ferruginous, at apex dark fuscous, towards tornus pale ochreous-yellowish. Hindwings pale ochreous-yellowish, becoming deeper towards apex, dorsal half grey ; cilia pale yellowish, round apex grey on outer half ; in ♀ on costa with a thickened patch of dense-grey scales from beyond middle to near apex.

Seven specimens, Maskeliya, Puttalam, and Newera Eliya, Ceylon, from July to September (Green). Bred from larvæ feeding in fruit of plum in May (Green) ; but very probably the larva is a general feeder. This species is very similar to the European *C. podana ;* it may be distinguished structurally by the approximation of veins 7 and 8 of forewings towards base (in *podana* these diverge from base), the much broader costal fold of ♂, the prominent termen of forewings, and in ♀ the thickened patch of scales in costal cilia of hindwings ; and also by the grey colour of the hindwings being confined to dorsal half, whereas in *podana* it extends towards costa anteriorly.

PHALONIADÆ.

Tribonica, n. g.

Antennæ in ♂ biciliated with very long fine cilia. Palpi long, porrected. Thorax smooth ; posterior tibiæ clothed with long hairs above. Forewings without costal fold in ♂, surface with tufts of raised scales ; 2 from very near angle of cell, 3 and 4 stalked from angle, 7 to termen, 8 and 9 long-stalked. Hindwings with 2, 3, 5 approximated at base, 4 absent, 6 to apex, 7 absent ; lower margin of cell with basal pecten of hairs.

Closely allied and superficially very similar to *Heterocrossa*, but immediately distinguished by the stalking of veins 3 and 4, 8 and 9 of forewings.

Tribonica eremitis, n. sp.

♂ ♀. 17-24 mm. Head white, crown in ♀ sprinkled with fuscous. Palpi in ♂ 3, in ♀ 4, white, externally suffused with pale ochreous and densely irrorated with blackish-fuscous. Thorax whitish, shoulders infuscated, in ♀ more or less irrorated with fuscous. Abdomen shining whitish. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen straight, oblique, rounded beneath; whitish, in ♂ slightly, in ♀ more strongly strewn with fuscous, grey, and blackish scales; a small brownish-tinged basal patch, edged by a nearly straight ridge of raised scales mixed with dark fuscous anteriorly from $\frac{1}{6}$ of costa to $\frac{1}{6}$ of dorsum; two white tufts above and below middle at $\frac{1}{3}$, edged anteriorly with dark fuscous; a transverse ridge of white scales in disc at $\frac{2}{3}$, anteriorly dark fuscous, and preceded by a patch of more or less dark suffusion; and ill-defined fuscous subterminal shade, more distinct in ♀; cilia fuscous whitish, basal half faintly darker-barred. Hindwings and cilia ochreous-grey-whitish.

Seven specimens, Maskeliya, Ceylon, in March (Pole).

Trymalitis, n. g.

Antennæ in ♂ simple. Palpi moderate, subascending. Thorax smooth. Anterior femora in ♂ with expansible hair pencil from base; middle and posterior tibæ clothed with long fine hair above. Forewings without costal fold in ♂; 2 from posterior fourth of cell, 3 and 5 approximated at base, 4 absent, 7 to apex, 8 and 9 stalked, 10 closely approximated to 8. Hindwings with 2 remote from angle, 3 and 4 short-stalked from angle, 5 slighlty approximated to 4, 6 and 7 long-stalked; lower margin of cell without basal pecten of hairs.

Probably belonging to the group of *Commophila*, but very distinct by the neuration of forewings.

Trymalitis margarias, n. sp.

♂. 17-20 mm. Head whitish mixed with ferruginous. Palpi white, second joint dark fuscous above. Thorax white, spotted with grey. Abdomen yellowish-grey. Forewings elongate, posteriorly dilated, costa slightly arched, apex round pointed, termen sinuate beneath apex, rounded, oblique; whitish with rows of undefined fuscous strigulæ or roundish spots between veins, becoming obsolete towards middle of disc; costa and dorsum shortly strigulated with dark fuscous; a dark fuscous discal dot above middle; a rather broad fuscous fascia at $\frac{3}{4}$ parallel to termen, marked with darker; an orange apical spot, enclosing a white crescentic mark; a praeterminal series of dark fuscous strigulæ in fuscous spots; cilia white, with an orange basal spot at apex, and three or four faint fuscous bars on outer half round apex. Hindwings grey, paler or whitish towards base, veins streaked with ochreous-fuscous, apex white; cilia white, sometimes with a grey basal spot at apex.

Two specimens, Kandy and Puttalam, Ceylon, in October and November (Green).

GELECHIADÆ.

Sitotroga cerealella. Ol.

Newera Eliya, Ceylon, in March and June (Green). This now cosmopolitan insect (stated by Mr. Green to be destructive to rice) will probably be found generally distributed, though liable to be overlooked ; the larva feeds on grain of all kinds, and may do great damage in granaries.

Chaliniastis metrodelta, n. sp.

♂. 15 mm. Head fuscous, sides ochreous-yellow. Palpi pale ochreous-yellow, second joint with lower ⅔ and almost apical ring fuscous externally, terminal joint as long as second, with base and anterior edge, except towards base dark fuscous. Antennæ dark grey. Thorax purplish-fuscous. Abdomen fuscous, darker posteriorly, apex ochreous-yellow. Posterior tibiæ shortly rough-scaled above. Forewings elongate, narrowed anteriorly, posteriorly rather dilated, costa gently arched, apex obtuse, termen nearly straight, somewhat oblique, rounded beneath ; fuscous, slightly purplish-tinged ; costal edge ochreous orange, somewhat suffused into ground colour ; straight parallel transverse whitish-ochreous lines at ⅖ and beyond ⅘, first followed by a triangular dorsal ochreous-brown patch, reaching ¾ across wing, edged with dark fuscous posteriorly, second rather broadly edged with dark fuscous posteriorly ; second discal stigma dark fuscous, edged with whitish-ochreous ; a dark fuscous line round termen and apex, interrupted by ochreous-yellow dots ; cilia ochreous-yellow, beneath tornus dark fuscous. Hindwings somewhat over 1, fuscous, slightly brassy-tinged ; cilia ½, whitish-fuscous, with two fuscous shades.

One specimen, Maskeliya, Ceylon, in March (Pole).

Thiotricha orthiastis, n. sp.

♂. 13 mm. Head shining, bronzy-fuscous, with pale reflections. Palpi light bronzy-grey, base whitish. Antennal ciliations 3. Thorax and abdomen bronzy-fuscous. Forewings elongate, very narrow, costa gently arched, apex pointed, termen extremely obliquely rounded ; 9 out of 6 ; dark fuscous ; a broad ochreous-white streak occupying costal half from base, from middle onwards gradually attenuated and leaving costal edge, not quite reaching apex ; a fine white strigula between this and apical fifth of costa ; a black apical mark ; cilia grey, round apex ochreous-white with two dark fuscous lines. Hindwings almost 1, cilia 2½ : grey, darker posteriorly ; cilia grey.

One specimen, Rawalpindi, Punjab (Manders).

Epithectis studiosa, n. sp.

♂ ♀. 9-10 mm. Head, palpi, antennæ, thorax, and abdomen ochreous-whitish, tinged with pale fuscous. Forewings elongate, lanceolate; pale whitish-ochreous, brownish-tinged, towards apex with scales somewhat roughened ; an obscure streak of fuscous suffusion from disc beyond middle to apex ; cilia whitish-ochreous. Hindwings with apex somewhat produced termen sinuate, 5 basally obsolescent ; pale whitish-ochreous ; cilia pale whitish-ochreous.

Four specimens, Peradeniya, Ceylon, in December (Green). Larva destructive to dried plants in herbarium (Green). The larval habit is singular, but in this specialised form must be quite recent; it will doubtless be found to feed naturally under other circumstances.

Gelechia gossypiella. Saund.

Surat, Bombay (Maxwell-Lefroy). This species, described by Saunders as a *Depressaria,* is a true *Gelechia*, nearly allied to the European *G. malvella,* which feeds on an allied plant in the same way. It is stated to be very destructive to cotton.

Gnorimoschema heliopa. Low.

Peradeniya, Ceylon (Green); Cambay, Bombay (Maxwell-Lefroy). This species is Australian, and belongs to a group of nearly allied species native to that region, but its food plant has not been noticed there; it might prove to be an indigenous *Solanum.* In India and Ceylon it is a serious pest of the tobacco plant (*Nicotiana*); " the larva bores into the stem, and ultimately causes death; its presence may be known by a swelling of the green stem; it usually affects quite small plants in nurseries, but sometimes older plants; the point of infection is often on underside of midrib of leaf" (Green). It does not appear to be known in America, the home of the tobacco plant; I showed specimens to Mr. Busck, the principal authority on North American *Tineina*, and he was unacquainted with it; but a similar (probably the same) insect is reported to be destructive in Java. The moth is a small mottled yellow-brown species, resembling an ordinary *Gelechia* of the *obsoletella* group.

Tipha. Walk.

Antennæ over 1, in ♂ simple, basal joint sometimes with short apical prominence, Labial palpi in ♂ variably modified, second joint often much enlarged with projecting scales, terminal joint often more or less aborted; in ♀ long, recurved, second joint with oppressed scales, slightly rough beneath towards apex, terminal joint as long as second, slender, acute. Posterior tibiæ and tarsi sometimes clothed with projecting scales above. Forewings with 3 absent, 2 and 4 approximated or stalked or coincident, 7 and 8 stalked or coincident, 7 to costa or apex on termen, 9 sometimes out of 7. Hindwings 1, elongate-trapezoidal, in ♂ apex obtuse, termen sinuate or rounded, in ♀ apex round-pointed, termen sinuate, cilia 1; in ♂ 3 absent, 2 and 4 connate or stalked, 5 absent, 6 and 7 connate or stalked, or coincident cell sometimes open, in ♀ 2 remote, 3 and 4 connate or stalked, 5 near, parallel, 6 and 7 connate or stalked.

This genus shows considerable variation of structure, especially in veins 7—9 of forewings, and in the often greatly modified palpi and other secondary sexual characters of the ♂; but I have no doubt that the different forms are properly included in the same genus, which remains easily definable. From *Timyra* it is readily distinguished by the absence of vein 3 in forewings, the presence of vein 5 in hindwings of ♀, and the want of the large median tuft of posterior tibiæ. The curious modification of the palpi of ♂ occurs in varying degree in some species of *Timyra*, *Crocanthes*, and other allied genera, and is certainly only a specific character. *Cacogamia*, Snell, would seem from the descriptions to be a synonym of this genus.

Tipha monetella. Feld.

(*Anarsia monetella.* Feld., Reis. Nov. pl. CXXXIX, 19.)

Maskeliya, Ceylon, in February (Pole).

Tipha pharetrata, n. sp.

♂ ♀. 20-21 mm. Head light ochreous-orange, crown in ♀ suffused with purple-fuscous. Palpi in ♂ obliquely ascending, clothed with dense long projecting scales beneath so as to be spoon-shaped, obtuse, terminal joint minute, concealed; dark shining steel-grey, towards base light ochreous-orange, in ♀ wholly light ochreous-orange. Antennæ ochreous-yellow, more or less suffused with grey towards tip. Thorax ochreous-orange, patagia purplish-fuscous. Abdomen whitish-yellowish, mixed with grey, especially in ♀. Legs ochreous-yellowish, anterior tibiæ in ♂ with recurved flap of dense yellowish grey scales beneath; posterior tibiæ orange, with shining bronze marks above near base and beyond middle, slightly rough and with black spots above on origin of spurs. Forewings elongate, narrow, costa gently arched, apex rounded, termen extremely obliquely rounded; 2, 4, 5 approximated, 7 to costa, 8 absent, 9 separate; orange, lighter and more ochreous-tinged towards costa; markings shining silvery-bronze; a spot on base of costa; a line along submedian fold from rather near base to beyond middle of wing; a longitudinal discal line from beyond $\frac{1}{3}$ to $\frac{3}{5}$, dilated at extremities, and a longitudinal spot above its posterior extremity; six streaks on veins starting from beyond $\frac{3}{5}$, and running to posterior part of costa and termen: cilia ochreous. Hindwings in ♂ with 2, 4, 5 approximated, 6 and 7 connate, in ♀ 3 and 4 short-stalked; in ♂ light yellowish-fuscous, in ♀ grey; cilia pale brownish-ochreous, in ♀ pale yellowish round apex and upper part of termen; in ♂ with large expansible subdorsal pecten of pale yellowish hairs.

Two specimens, Kandy and Peradeniya, Ceylon (Green).

Tipha spectralis, n. sp.

♂. 21 mm. Head shining golden. Palpi clothed with dense long projecting scales beneath so as to be spoon-shaped, obtuse, terminal joint concealed; shining metallic grey, above and beneath suffused with ochreous-yellow. Antennæ dark fuscous, with obscure median band of pale ochreous suffusion. Thorax ochreous-orange, sides and posterior extremity shining metallic grey. Abdomen ochreous-yellowish. Legs yellowish, anterior tibiæ dark grey above, with flap of recurved pale ochreous-yellowish hairs beneath, posterior tibiæ and basal joint of tarsi clothed with long hairs above. Forewings elongate, narrow, costa gently arched, apex rounded, termen extremely obliquely rounded; 2 and 4 connate, 5 parallel, 7 and 8 stalked, 7 to termen; light shining bronzy-fuscous; costa suffused with ochreous-yellow, except a basal spot; dorsum suffused with ochreous-yellow anteriorly, connected with costal suffusion near base, and by a bar at $\frac{1}{5}$; an indistinct ochreous-yellowish transverse mark below middle of disc: cilia pale shining bronzy, on costa and towards tornus yellowish-suffused. Hindwings with termen rather abruptly sinuate, 2, 4, 5 approximated, 6 to apex, 7 absent; light grey, yellowish-tinged, towards costa suffused with yellow-ochreous; a deep longitudinal median groove throughout, beneath which towards base is a dense expansible pecten of long yellowish hairs; cilia pale ochreous.

One specimen, Maskeliya, Ceylon (Pole).

Tipha pyrophanes, n. sp.

♀. 20 mm. Head and thorax shining purplish-bronzy fuscous. Palpi ochreous-yellow. Antennæ fuscous. Abdomen grey. Legs yellowish, anterior femora and tibiæ metallic grey, posterior tibiæ smooth, deep yellow, apex dark grey. Forewings elongate, narrow, costa gently arched, apex rounded, termen extremely obliquely rounded; 2 and 4 approximated, 5 parallel, 7 and 8 stalked, 7 to termen; deep orange; markings shining purplish-leaden-grey; a very small basal patch; a small spot in disc at $\frac{1}{5}$; a very large patch occupying entire apical $\frac{2}{3}$ except towards margins anteriorly, enclosing an irregularly triangular patch of ground colour in disc about $\frac{3}{5}$; cilia shining grey. Hindwings with 6 and 7 stalked; grey; cilia light grey, towards base suffused with whitish-ochreous.

One specimen, Pundalu-oya, Ceylon, in February (Green).

Tipha phalaritis, n. sp.

♀. 18 mm. Head and throax bluish-bronzy-fuscous. (Palpi broken.) Antennæ rather dark fuscous, with whitish median band. Abdomen dark grey. Legs orange, femora and anterior tibiæ grey, apex of middle and posterior tibiæ dark grey, posterior tibiæ with a tuft of grey hairs above on origin of median spurs, tarsi whitish. Forewings elongate, narrow, costa gently arched, apex rounded, termen very obliquely rounded; 2 and 4 approximated, 5 parallel, 7 and 8 stalked, 7 to termen; deep reddish-orange; markings purplish-fuscous; a very small basal patch; a discal dot at $\frac{1}{5}$; a reniform blotch in disc slightly before middle; a terminal blotch occupying posterior fourth of wing: cilia pale shining fuscous, with brassy-purplish reflections. Hindwings with 6 and 7 stalked; rather dark fuscous; cilia fuscous, paler towards tips.

One specimen, Kandy, Ceylon, in September (Green).

Tipha brochias, n. sp.

♂. 20 mm. Head shining bronze, sides yellowish. Palpi with second joint loosely haired, terminal joint minute; ochreous-yellow, towards base sprinkled with dark fuscous. Antennæ pale ochreous, towards base and apex becoming dark fuscous. Thorax dark bronzy-fuscous, tips of palagia tinged with brassy-ochreous. Abdomen dark fuscous, apex ochreous-yellow. Legs ochreous-yellow, anterior femora and tibiæ dark fuscous above, apex of middle femora and tibiæ dark fuscous, posterior tibiæ beyond median spurs, and basal joint of posterior tarsi dark fuscous, scales slightly raised on origin of spurs. Forewings elongate, narrow, costa gently arched, apex rounded, termen very obliquely rounded; 2 and 4 approximated, 5 parallel, 7 and 8 stalked, 7 to termen; orange, paler towards costa; markings bronzy-fuscous, darker-edged, suffused with shining purplish-leaden ; an elongate costal blotch at base, extended in disc to connect with an elongate loop-shaped discal blotch reaching to $\frac{3}{5}$; a streak along dorsum from near base to beyond middle ; a terminal patch occupying apical third, its anterior edge convex : cilia bronzy-fuscous. Hindwings with 2, 4, 5 approximated, 6 and 7 connate ; a slight discal groove and ridge of scales towards base ; dark fuscous ; an irregular ochreous-yellow patch in disc towards base ; cilia fuscous.

One specimen, Maskeliya, Ceylon (Pole).

Timyra. Walk.

Antennæ over 1, in ♂ simple, basal joint elongate, in ♂ sometimes densely tufted. Labial palpi long, recurved, second joint in ♂ sometimes clothed with long loose rough hairs, or with fine expansible hairs inwardly, in ♀ with appressed scales, rough beneath, terminal joint in ♂ sometimes very short, thickened with scales, rough anteriorly, in ♀ nearly or quite as long as second, slender, acute, loosely scaled. Anterior tibiæ with brush of scales beneath, posterior tibiæ with large dense median tuft of long hair scales above in both sexes, posterior tarsi thickened with rough scales or with fringe of long hairs above. Forewings with 2 remote from angle, 7 and 8 stalked, 7 to termen or apex. Hindwings over 1, trapezoidal, apex obtuse, termen not sinuate, cilia $\frac{2}{3}$, in ♂ usually with deep groove beneath cell, containing long hair-pencil ; in ♂ 3 absent, 2 and 4 approximated or stalked, in ♀ 2 remote, 3 and 4 separate or stalked ; 5 absent, 6 and 7 stalked.

Obviously allied to *Crochantes,* which is, however, immediately distinguished by the absence of veins 2 and 9 of forewings ; the large scale tuft of posterior tibiæ in both sexes is a quite peculiar character.

Decuaria, Walk., is a synonym.

Timyra machlas, n. sp.

♂ ♀. 20-22 mm. Head bronzy-fuscous, sides ochreous-whitish, in ♂ with scales of crown directed forwards above antennæ. Palpi ochreous-whitish mixed with dark fuscous, in ♂ with basal joint dilated, second joint much enlarged, very long and thickened with dense scales, above with fringe of long projecting hairs and on inner side with long expansible whitish hair-pencil, terminal joint $\frac{1}{4}$ of second, thickened with dense dark fuscous scales, in ♀ second joint with appressed scales, terminal joint as long as second, both with anterior edge blackish. Antennæ whitish-ochreous, in ♀ ringed, in ♂ suffused with fuscous, basal joint in ♂ with large whitish-ochreous tuft of scales in front, hollowed and dark fuscous on inner side. Thorax fuscous, collar fuscous, whitish. Abdomen pale ochreous. Legs ochreous-yellow, anterior pair dark fuscous, except part of tarsi, middle tibiæ whitish banded with dark fuscous posterior tibiæ and tarsi with long fine projecting hairs above, spotted and streaked with dark fuscous, median tuft of tibiæ ochreous-yellow, mixed with dark fuscous. Forewings elongate, rather narrow, costa gently arched, apex in ♂ obtuse, in ♀ round-pointed, termen straight, rather oblique, rounded beneath ; 7 to apex ; light brown, mixed with darker ; basal area mixed with orange, and with orange median and plical streaks to middle ; in ♂ a sub-basal tuft of erect scales ; beyond middle a broad orange slightly oblique transverse fascia ; posterior area with white lines on veins, and along costa and termen : cilia pale ochreous, base orange-tinged, with two dark fuscous shades. Hindwings in ♂ whitish-ochreous, posteriorly suffused with fuscous, in ♀ fuscous ; cilia as in forewings.

Two specimens, Kandy, Ceylon, in September and October (Green).

Timyra mendicella. Walk.

(*Decuaria mendicella*, Walk. Cat. Tin. 797.)

Palpi with appressed scales, very long, slender, alike in both sexes. Antennæ in ♂ with large tuft of scales from basal joint in front, hollowed on inner side. Posterior tibiæ and tarsi with loose rough projecting scales above, median tuft of tibiæ very large, scales yellowish, tipped with black or suffused with dark fuscous. Forewings with vein 7 to termen. Hindwings as in *T. sphenias.*

Two specimens, Pundalu-oya, Ceylon, in March (Green).

Timyra metallanthes, n. sp.

♂. 19 mm. Head pale ochreous, crown fuscous-tinged. Palpi whitish-ochreous, second joint fringed with projecting hairs above, terminal joint as long as second, slender. Antennæ whitish-ochreous, ringed with fuscous beneath, basal joint with large tuft in front, on inner side hollowed and mixed with dark fuscous. Thorax light shining brownish-ochreous. Abdomen pale ochreous. Legs whitish-ochreous, anterior tibiæ dark fuscous, fringed with hairs beneath, middle tibiæ suffused with dark fuscous, with expansible hairs towards apex above, posterior tibiæ and first three joints of tarsi with projecting hairs above, median tuft of tibiæ very large, mixed with shining metallic grey and black scales. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen straight, rather oblique, rounded beneath ; 7 to termen ; fuscous, irrorated with whitish-ochreous except on basal and terminal areas ; an indistinct cloudy whitish-ochreous fascia at $\frac{1}{4}$; an orange fascia before $\frac{3}{4}$, dilated on costa ; cilia whitish-fuscous, with darker sub-basal shade, base pale orange-ochreous. Hindwings fuscous, paler and thinly scaled towards base, hair-pencil ochreous-yellowish ; cilia whitish-ochreous, more yellowish towards base.

One specimen, Maskeliya, Ceylon (Pole).

Timyra sphenias, n. sp.

♂ ♀. 25-28 mm. Head and thorax fuscous, crown yellowish-mixed, in ♂ with hairs raised round a quadrate pale ochreous-yellowish area above antennæ. Palpi fuscous, somewhat mixed with ochreous yellowish, in ♂ with second joint clothed with loose rough hairs, terminal joint half second, much thickened with loose scales, in ♀ second joint thickened with loose scales, terminal joint nearly as long as second, tolerably slender. Antennæ ochreous-yellowish, beneath infuscated, basal joint in ♂ with large tuft of fuscous scales in front. Abdomen ochreous-yellow. Legs purplish-fuscous partially mixed or suffused with ochreous-yellowish, posterior tibiæ clothed with rough projecting hairs beneath on basal half, posterior tarsi clothed with rough projecting hairs above, more strongly in ♂. Forewings elongate, narrow, posteriorly somewhat dilated, costa slightly arched, apex obtuse, termen straight, rather oblique, rounded beneath ; 7 to termen ; purplish-fuscous. irregularly irrorated with dark fuscous, sometimes posteriorly sprinkled with whitish-ochreous ; a transverse elongate-triangular ochreous-yellow blotch beyond middle, apex downwards, more or less nearly touching both margins : cilia fuscous, becoming ochreous-yellow towards base, with a darker fuscous subbasal line. Hindwings pale ochreous-yellowish ; termen in ♀ narrowly suffused irregularly with fuscous, in ♂ only at apex and towards tornus ; cilia pale ochreous-yellowish.

Three specimens, Maskeliya, Peradeniya, and Pundalu-oya, Ceylon, in March and August (Green).

Macrotona platyconta n. sp.

♂. 16—20 mm. Head and thorax ochreous-white. Palpi whitish irrorated with fuscous and dark fuscous, second joint roughened towards apex above and beneath, terminal joint slightly shorter than second. Antennæ very stout, flatly compressed, ochreous-whitish, tip dark fuscous. Abdomen ochreous-whitish. Forewings elongate, rather narrow, costa gently arched, apex round pointed, termen sinuate, oblique, rounded beneath ; 7 to termen, 9 separate ; ochreous-whitish, towards costa and dorsum tinged and sprinkled with fuscous, costa posteriorly more or less suffused with fuscous ; some scattered blackish or dark fuscous scales on submedian fold ; irregular groups of black and dark fuscous somewhat raised scales representing stigmata, plical before first discal : cilia pale whitish-ochreous, outer half irrorated with fuscous. Hindwings with 3 and 4 connate or short-stalked, 6 and 7 long-stalked : light fuscous ; cilia pale whitish-ochreous, outer half irrorated with fuscous round apex.

Two specimens, Maskeliya, Ceylon, in January (Pole).

Pharangitis n. g.

Antennæ $\frac{5}{6}$, in ♂ thick, simple, basal joint moderate, without pecten. Labial palpi long, curved, ascending, second joint thickened with scales, roughly projecting towards apex beneath, terminal joint as long as second, slender, acute. Forewings with 3 absent, 2, 4, 5 separate, 8 and 9 out of 7, 7 to termen. Hindwings 1, elongate, apex round-pointed, terment faintly sinuate cilia 1 ; 3 and 4 remote, 5 parallel, 6 and 7 long-stalked.

Apparently allied to *Macrotona*.

Pharangitis spathias n. sp.

♂. 15 mm. Head and thorax white, patagia brownish-ochreous. Palpi ochreous-yellowish, apex of second joint white, terminal joint white towards base. Antennæ white, becoming whitish-ochreous towards apex. Abdomen ochreous-yellowish. Forewings elongate, rather narrow, costa gently arched, apex round-pointed, produced, termen concave, oblique, rounded beneath ;

rather deep brownish-ochreous; a clear white costal streak from base to $\frac{5}{6}$ attenuated posteriorly; dorsum slenderly white towards base: cilia brownish-ochreous, blackish-grey at apex and on a median shade disappearing towards tornus, beyond this whitish-yellow on termen. Hindwings whitish-ochreous, slightly infuscated towards apex; cilia whitish-ochreous.

One specimen, Maskeliya, Ceylon, in March (Pole).

Antiochtha n. g.

Antennæ almost 1, in ♂ simple, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with rough scales beneath, terminal joint longer than second, slender, acute. Posterior tarsi with basal joint thickened with rough scales above. Forewings with 2 and 3 stalked, 5 absent, 8 and 9 out of 7, 7 to termen. Hindwings 1, trapezoidal, apex obtuse, termen not sinuate, cilia 1; 3 and 4 connate, 5 absent, cell open, 6 and 7 stalked.

Allied to *Onebala.*

Antiochtha balbidota n. sp.

♂. 17-18 mm. Head pale greyish-ochreous. Palpi whitish, second joint irrorated with dark fuscous except towards apex, terminal joint with extreme base and upper $\frac{2}{3}$ of anterior edge dark fuscous. Antennæ pale ochreous. Thorax pale ochreous, mixed with whitish and dark fuscous. Abdomen whitish-ochreous. Forewings elongate, rather narrow, costa anteriorly gently arched, posteriorly nearly straight, apex obtuse, termen straight, oblique, rounded beneath; light fuscous with some scattered dark fuscous scales, median area suffusedly mixed with whitish; a short blackish bar from base of costa; a narrow irregular blackish fascia from $\frac{1}{4}$ of costa to before middle of dorsum, more or less obsolete on dorsum, edged posteriorly with whitish suffusion; a round blackish dot, edged with whitish suffusion, in disc beyond middle; an ill-defined cloudy whitish transverse line from $\frac{3}{4}$ of costa to before tornus, somewhat angulated outwards in middle; edge of termen and tornus suffused with dark fuscous: cilia rather dark fuscous sprinkled with pale points, at base and beneath tornus pale greyish-ochreous. Hindwings light fuscous, darker on termen; cilia pale whitish-ochreous, with two fuscous shades.

Two specimens, Maskeliya, Ceylon (Pole).

Onebala cremnaspis n. sp.

♂. 21-22 mm. Head and thorax bronzy-fuscous. Palpi ochreous-whitish, second joint externally suffused with rather dark fuscous except towards apex, terminal joint longer than second. Antennæ whitish-ochreous, indistinctly ringed with fuscous. Abdomen pale-bronzy-ochreous. Legs ochreous-whitish, anterior and middle tibiæ and tarsi blotched with dark fuscous, posterior tibiæ dark-fuscous. Forewings elongate, narrow, costa gently arched, apex round pointed, termen concave, rather oblique, rounded beneath; 2 from angle, 4 and 5 stalked, 7 to apex; bronzy-fuscous; extreme costal edge whitish-ochreous except towards base; markings blackish fuscous, finely edged with whitish-ochreous; an irregular triangular dorsal blotch before middle, reaching $\frac{4}{5}$ across wing, confluent on dorsum with a triangular posterior dorsal patch of dark fuscous suffusion, whose apex reaches costa at $\frac{3}{4}$, its posterior edge limited by a nearly straight fine whitish-ochreous line; a small spot on costa before middle, and a small oblique oval spot in disc beyond middle : cilia light fuscous-ochreous, with broad rather dark grey sub-basal shade, beneath tornus wholly dark grey. Hindwings pale ochreous, apex and termen narrowly suffused with fuscous ; cilia pale fuscous, at base and towards tornus becoming whitish-ochreous.

Two specimens, Maskeliya, Ceylon, in February (Pole). The colouring of the posterior legs is a curious feature, being the reverse of what almost invariably obtains.

Torodora xerastis n. sp.

♂♀. 15-16 mm. Head, palpi, and thorax ochreous-bronzy. Forewings elongate, narrow, costa slightly arched, apex obtuse, termen slightly rounded oblique : 7 to apex, 9 separate ; brownish-ochreous, ferruginous-tinged sometimes suffused with rather dark fuscous on dorsal half anteriorly and on veins posteriorly ; stigmata ferruginous-ochreous with some dark fuscous scales, partially edged with whitish, plical elongate, dash-like, rather before first discal ; a terminal series of fuscous or dark fuscous dots : cilia brownish ochreous sprinkled with whitish. Hindwings pellucid, grey-whitish, posteriorly and on veins suffused with greyish-ochreous : cilia whitish-ochreous.

Two specimens, Mooltan, Punjab, in August (Manders).

Torodora episticta n. sp.

♀. 18 mm. Head, palpi, antennæ, thorax, and abdomen whitish-ochreous ; second joint of palpi fuscous except towards apex. Forewings elongate, costa gently arched, apex obtuse, termen sinuate, somewhat oblique, rounded beneath; 7 to termen, 9 separate; whitish-ochreous, with a few scattered grey and blackish scales ; a black dot on base of costa, and one beneath costa near base ; a dark grey dorsal dot near base ; stigmata rather large, blackish, plical rather beyond first discal ; an almost marginal series of undefined blackish dots beneath posterior half of costa and round termen : cilia whitish-ochreous. Hindwings with 6 and 7 approximated at base ; ochreous-whitish ; cilia whitish-ochreous.

One specimen, Maskeliya, Ceylon (Pole).

Torodora epomia n. sp.

♂. 23 mm. Head, thorax, and abdomen bronzy-ochreous. Palpi ochreous-whitish, second joint externally suffused with ochreous and dark fuscous except towards apex. Antennæ pale ochreous mixed with fuscous. Forewings elongate, posteriorly somewhat dilated, costa gently arched, apex round-pointed, termen sinuate, oblique, rounded beneath ; 7 to termen, 9 separate ; bronzy-ochreous, suffused with pale brownish except towards anterior $\frac{2}{3}$ of costa ; a spot of dark purple-fuscous suffusion on base of costa ; stigmata dark fuscous, discal small, indistinct, plical and an additional dot beneath second discal large, plical directly beneath first discal : cilia light ochreous. Hindwings grey, lighter towards base ; cilia pale ochreous, with grey sub-basal shade.

One specimen, Maskeliya, Ceylon, in August (Green).

Torodora spilotella Walk.

(*Cryptolechia spilotella* Walk. Tin. 746 ; *C. tripustulata* Wals., Lep. Ceyl. iii, 520, pl. 209, 8).

Peradeniya, Ceylon, in April and November (Green).

Paraspistes n. g.

Antennæ $\frac{4}{5}$, in ♂ simple, basal joints elongate, without pecten. Palpi moderately long, curved, ascending, second joint thickened with appressed scales expanded above towards apex, terminal joint shorter than second, acute. Posterior tibiæ clothed with long fine hairs above. Forewings with 2 widely remote, 3 and 4 connate from angle, 5 from near 4, 6 out of 7 near base, 7 and 8 stalked, 7 to costa, 9 approximated to 7. Hindwings under 1, trapezoidal, apex produced, termen bisinuate, cilia 2 ; 2 remote, 3 and 4 short-stalked, 5 parallel, 6 and 7 stalked.

Allied to *Nothris*, and very similar in most characters, but the palpi are quite different.

Paraspistes ioloncha n. sp.

♂ ♀. 12-15 mm. Head and thorax pale ochreous. Palpi ochreous-whitish, second joint suffused with fuscous except at apex. Forewings elongate, narrow, widest near base, costa hardly arched, apex round-pointed, termen extremely obliquely rounded ; pale ochreous, dorsal half-suffused with light brown ; a ferruginous-brown streak along costa from before middle to near apex, cut by a fine pale oblique strigula at $\frac{4}{5}$, beyond this mixed with blackish ; stigmata blackish, sometimes indistinct, plical very obliquely before first discal, which is in middle of wing ; three undefined dots of blackish scales before termen ; cilia pale ochreous. Hindwings grey, darker posteriorly ; cilia grey.

Four specimens, Peradeniya, Ceylon, in July (Green). Larva feeds in pods of *Crotalaria sp.* (Green).

Hypelictis n. g.

Antennæ $\frac{4}{5}$, in ♂ shortly ciliated, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with dense scales, somewhat rough beneath and with fringe of rough projecting scales above, terminal joint shorter than second, densely scaled, somewhat rough anteriorly and with fringe of rough projecting scales posteriorly. Forewings with 2 and 3 stalked, 4 and 5 rather approximated, 7 to costa, 8 absent. Hindwings $1\frac{1}{2}$, trapezoidal, apex obtuse, termen not sinuate, cilia $\frac{1}{2}$: 3 and 4 connate, 5 parallel, 6 and 7 stalked.

Allied to *Ypsolophus* and *Anorthosia*.

Hypelictis acrochlora n. sp.

♂. 18 mm. Head, palpi, antennæ, and thorax dark purplish-bronzy-fuscous. Abdomen fuscous. Forewings elongate, rather narrow, costa anteriorly moderately arched, posteriorly nearly straight, apex rounded, termen somewhat obliquely rounded, apex somewhat distorted and bent over so as to be concave beneath ; dark shining purplish-bronzy-fuscous ; a hardly paler obtusely angulated transverse line from $\frac{4}{5}$ of costa to tornus ; apical distorted portion pale shining ochreous : cilia shining bronzy-fuscous, basal half-mixed with pale ochreous and ferruginous. Hindwings fuscous, paler towards base, subdorsal hairs pale whitish-ochreous; cilia whitish-ochreous, partially suffused with pale fuscous, round apex with darker fuscous.

One specimen, Maskeliya, Ceylon, in February (Pole).

Ypsolophus deltaspis n. sp.

♂. 21 mm. Head and thorax fuscous. Palpi with second joint dark fuscous, tip grey-whitish, tuft long, rather triangular, terminal joint much longer than second, ochreous-whitish sprinkled with dark fuscous, with subapical dark fuscous band. Antennæ greyish-ochreous ringed with dark fuscous. Abdomen rather dark fuscous. Forewings elongate, rather narrow, slightly dilated posteriorly, costa gently arched, somewhat sinuate in middle, apex round-pointed, termen concave, little oblique, rounded beneath; greyish-ochreous, strigulated with ferruginous-brown; a small blackish spot on base of costa and a dot beneath costa near base; costal edge anteriorly pale rosy, strigulated with blackish; a triangular blackish spot on costa before middle, reaching $\frac{1}{3}$ across wing; a transverse streak of ferruginous-brown suffusion from dorsum before $\frac{1}{4}$, reaching more than half across wing; discal stigmata small ferruginous-brown, near together; an undefined fascia of ferruginous-brown suffusion about $\frac{3}{4}$, terminating on costa in a darker spot mixed with blackish: cilia pale ferruginous, with an indistinct grey line. Hindwings rather dark fuscous; cilia fuscous.

One specimen, Kandy, Ceylon, in September (Green).

XYLORYCTIDÆ.

Amphoritis n. g.

Antennæ $\frac{4}{5}$, in ♂ minutely ciliated, basal joint thickened with scales above, without pecten. Labial palpi long, recurved, second joint thickened with rough scales beneath, terminal joint as long as second, acute. Anterior tibiæ and tarsi very short, posterior tibiæ loosely haired. Forewings with costal scale-projections before and beyond middle; 2 from $\frac{4}{5}$ of cell, 3 from angle, 7 to costa, 8 absent. Hindwings 1, oblong-ovate, termen not sinuate, cilia $\frac{2}{3}$; 3 and 4 connate or stalked, 5 parallel, 6 and 7 stalked.

Allied to *Xylorycta*. Type *A. camelodes*.

Amphoritis camelodes n. sp.

♀. 20 mm. Head fuscous-whitish. Palpi whitish, terminal joint sprinkled with fuscous except at apex, with a blackish subapical ring Thorax fuscous-whitish mixed with pale brown. Abdomen pale greyish-ochreous. Forewings elongate, moderate, costa moderately arched, apex rounded-obtuse, termen rounded, vertical; fuscous-whitish, suffusedly irrorated with pale, fuscous, and posteriorly with light ferruginous; costal scale-projections tipped with light ferruginous-brown; stigmata minute, dark fuscous, plical slightly beyond first discal, second discal edged beneath by a small whitish scale-tuft; a much interrupted subterminal line of dark fuscous irroration beneath middle of costa near and parallel to costa and termen to before tornus; a terminal series of dark fuscous dots; cilia light brown, with a dark grey antemedian shade round apex and termen to below middle, beneath this whitish sprinkled with dark grey on basal half. Hindwings pale brassy fuscous, paler anteriorly ; cilia fuscous-whitish, with light fuscous subbasal shade.

One specimen, Kandy, Ceylon, in October (Green).

Amphoritis nycterodes n. sp.

♂ 13 mm. Head, thorax, and abdomen dark fuscous. Palpi whitish, mixed with dark grey, towards base ochreous-tinged, terminal joint with blackish sub-apical ring. Forewings sub-oblong, moderate, costa gently arched, more strongly towards base, apex rounded-obtuse, termen rounded, slightly oblique; dark fuscous, slightly ferruginous tinged ; stigmata small, blackish-fuscous, plical rather beyond first discal, second discal margined beneath by a dot of somewhat raised whitish scales; an indistinct blackish-fuscous angulated subterminal line, rather near and parallel to posterior part of costa and termen ; cilia grey mixed with darker, tips whitish-grey. Hindwings rather dark coppery-fuscous ; cilia fuscous.

One specimen, Haragam, Ceylon, in July (Green).

Xylorycta Meyr.

I propose to widen the definition of the genus *Xylorycta*, so far as to unite with it the genera *Lichenaula*, *Telecrates*, *Clerarcha*, *Plectophila*, and *Chalarotona*. These were all published by me at the same time, and I select the name of *Xylorycta* for the resulting group because I made that typical of the family and therefore gave it precedence. The structural characters are thus extended in the following particulars : Antennal ciliations of ♂ variable ($\frac{1}{2}$—3) ; 7 of forewings to apex or termen ; 6 and 7 of hindwings approximated, connate, or stalked.

Xylorycta paracyrta n. sp.

♂ 23 mm. Head, thorax and abdomen whitish-ochreous. Palpi white, second joint light fuscous except towards apex. Antennal ciliations 2. Forewings elongate, moderate, costa rather strongly arched, apex evenly rounded, termen strongly rounded so as to be prominent beneath apex ; 2 from $\frac{5}{6}$, 7 to apex ; whitish-ochreous ; a small round cloudy fuscous spot in disc beyond middle ; a faint curved transverse shade of fuscous suffusion at $\frac{4}{5}$, parallel to posterior part of costa and termen ; cilia whitish-ochreous, on costa and round apex suffused with ferruginous-brown, tips dark grey round apex. Hindwings and cilia pale whitish-ochreous ; 3 and 4 stalked, 6 and 7 stalked.

One specimen, Haputale, Ceylon, in February (Green).

Xylorycta psilotis n. sp.

♂ 16-17 mm. Head, thorax, and abdomen ochreous-whitish, head loosely haired. Palpi white, lower $\frac{2}{3}$ of second joint fuscous. Antennæ strongly biciliated (3). Forewings elongate, moderate, costa moderately arched, apex rounded obtuse, termen rounded, hardly oblique ; 2 from $\frac{5}{6}$, 7 to termen ; pale whitish-ochreous, thinly scaled ; discal stigmata indicated by two or three blackish scales, first sometimes absent ; an almost marginal series of dark grey or blackish dots along termen, sometimes little marked ; cilia ochreous-whitish. Hindwings and cilia ochreous-whitish ; 3 and 4 stalked, 6 and 7 stalked.

Four specimens, Peradeniya and Yatiyantota, Ceylon, in March, September, and November (Green).

Nephantis n. g.

Head with appressed scales, sidetufts small, slightly raised. Antennæ $\frac{3}{4}$, in ♂ filiform, simple, basal joint elongate, without pecten. Labial palpi very long, recurved, second joint clothed beneath and on inner side with long, rough expanded hairs, terminal joint as long as second, slender, acute. Anterior tibiæ and tarsi short, posterior tibiæ clothed with long hairs above. Forewings with 2 from $\frac{3}{5}$ of cell, 3,4, 5 approximated, 7 and 8 stalked, 7 to about apex. Hindwings, 1, elongate-ovate, cilia $\frac{1}{2}$; 3 and 4 stalked, 5 parallel, 6 and 7 short-stalked.

Allied to *Xylorycta,* but distinguished by the rough hairs of palpi. The apex of forewings is so rounded that the termination of vein 7 might be described as indefinite.

Nephantis serinopa n. sp.

♂ ♀. 20-28. mm. Head and thorax light greyish-ochreous, Palpi ochreous-whitish, hairs internally marked with fuscous. Abdomen pale ochreous. Forewings elongate, costa gently arched, apex rounded, termen obliquely rounded; pale greyish-ochreous, with some fine scattered blackish scales; extreme costal edge whitish; first discal stigma raised, dark fuscous, plical and second discal indistinct, indicated by two or three dark fuscous scales, plical obliquely before first discal; in ♂ a bare whitish-ochreous patch towards dorsum near base; cilia whitish, towards base mixed with pale fuscous. Hindwings whitish ochreous tinged with fuscous; cilia, whitish, towards base fuscous-tinged.

Five specimens, Batticaloa, Ceylon, in April (Green). Larva conceals itself beneath galleries of web and excreta on undersurface of leaves of cocoanut palm; in bad attacks the palm fronds are completely skeletonized; a serious pest (Green).

ŒCOPHORIDÆ.

Eulechria autogramma n. sp.

♂. 17 mm. Head ochreous-yellow. Palpi moderate, ochreous-yellow, second joint blackish except towards apex. Antennæ grey, ciliations $1\frac{1}{2}$. Thorax dark purplish-fuscous, posterior extremity ochreous-yellowish. Forewings elongate, costa moderately arched, apex obtuse, termen obliquely rounded; ochreous-yellow, with some scattered dark fuscous scales; markings dark purplish-fuscous; a basal fascia, widest on costa; stigmata moderate, plical slightly beyond first discal; a suffused elongate spot on costa towards middle; a triangular spot on dorsum towards middle, its apex almost confluent with plical stigma; a thick suffused curved subterminal line from $\frac{5}{6}$ of costa to tornus; cilia ochreous-yellow, dark fuscous on costal extremity of subterminal line. Hindwings grey, veins dark fuscous; cilia pale ochreous, with two fuscous shades disappearing towards apex.

One specimen, Maskeliya, Ceylon (Pole).

Macrosaces n.g.

Antennæ 1, in ♂ thick, serrulate, simple, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with loosely appressed scales, terminal joint as long as or shorter than second, slender, acute. Posterior tibiæ rough-haired above. Forewings with 2 from angle, 3 absent, 7 to costa, 8 absent, 11 from middle of cell. Hindwings 1, ovate-lanceolate, cilia 1¼; 3 and 4 connate.

A development of the *Phæosaces* group. Type *M. thermopa.*

Macrosaces thermopa n. sp.

♂. 18 mm. Head ochreous. Palpi long, whitish-ochreous, second joint suffusedly mixed with dark fuscous except at apex, terminal joint as long as second, sprinkled with dark fuscous. Antennæ fuscous. Thorax ochreous sprinkled with dark fuscous. Abdomen whitish-grey, apex whitish-ochreous. Forewings elongate, narrow, costa, gently arched, apex round-pointed, termen extremely obliquely rounded; rather deep ochreous, with scattered dark fuscous scales, on dorsal half and costal edge irrorated with dark fuscous; a small dark fuscous spot on base of costa; an irregular dark fuscous blotch in disc at ⅓, representing anterior stigmata; second discal stigma dark fuscous, and a similar dot below it, but obscured by dorsal irroration; a suffused dark fuscous apical blotch; cilia yellow-ochreous, paler towards tips, with a faint fuscous shade, above apical blotch grey. Hindwings pale grey; cilia whitish-ochreous.

One specimen, Maskeliya, Ceylon, in February (Pole).

Psaltica n. g.

Antennæ 1, in ♂ thick, serrulate, single, basal joint moderate, without pecten. Labial palpi long, recurved, second joint thickened with appressed scales, terminal joint as long as second, acute. Posterior tibiæ rough-haired above. Forewings with 2 from angle, 3 absent, 7 and 8 stalked, 7 to termen, 11 from middle. Hindwings 1, elongate-ovate, cilia 1; 3 and 4 connate.

Allied to *Macrosaces.*

Psaltica monochorda n. sp.

♂. 14 mm. Head glossy whitish-fuscous. Palpi whitish-fuscous, second joint sprinkled with dark fuscous. Antennæ pale fuscous. Thorax light glossy fuscous. Abdomen pale whitish-ochreous. Forewings elongate, rather narrow, costa moderately arched, apex round-pointed, termen extremely obliquely rounded glossy whitish-ochreous, tinged with brownish, with silvery reflections; basal half suffused with brown, limited by a fascia of dark fuscous suffusion, its posterior edge sharply defined and edged with white, running from middle of costa to beyond midle of dorsum, slightly concave; a dark fuscous discal dot at ⅗; a series of dark fuscous dots round posterior part of costa and termen: cilia whitish-ochreous, towards base brownish-tinged and sprinkled with fuscous. Hindwings pale grey; cilia whitish-ochreous, tinged with grey.

One specimen, Maskeliya, Ceylon (Pole).

Phæosaces Meyr.

I propose to extend the structural characters of this genus so as to include forms in which vein 7 of forewings runs to the termen, and also those in which the second joint of palpi is clothed with rough projecting hairs towards apex above. In view of this extension *Homosaces* will cease to exist, being merged in *Phæosaces.*

Phæosaces chrysocoma n. sp.

♂. 16 mm. Head orange-yellow. Palpi light orange, sprinkled with dark fuscous, terminal joint ⅔ of second, anterior edge dark fuscous. Antennæ fuscous. Thorax and abdomen dark purplish-fuscous. Legs yellow, anterior and middle pair banded with dark fuscous. Forewings elongate, costa gently arched, apex obtuse, termen oblique, slightly rounded ; 7 to apex ; dark shining purplish-bronzy-fuscous ; extreme costal edge yellow except at base and apex : cilia rather dark fuscous, tips ochreous-whitish on termen. Hindwings and cilia dark bronzy-fuscous.

One specimen, Pundalu-oya, Ceylon, in February (Green). Much like *P. anthocoma,* but differing by the apical termination of vein 7, and yellow costal edge of forewings.

Phæosaces orthotoma n. sp.

♀. 19 mm. Head whitish-fuscous. Palpi very long, second joint fuscous sprinkled with whitish, above with rough projecting whitish hairs, apex whitish, terminal joint whitish, anterior edge mixed with fuscous. Thorax light fuscous. Abdomen pale greyish-ochreous. Forewings sub-oblong, costa moderately arched, apex obtuse, termen oblique, slightly rounded ; 2 from before angle, 7 to apex ; pale fuscous ; costal edge narrowly whitish-ochreous ; discal stigmata dark fuscous, partially whitish-edged, second large, connected with apex of a triangular prætornal blotch of dark fuscous suffusion, its anterior edge vertical and margined with ochreous-whitish ; a terminal series of irregular dark fuscous dots continued round apex : cilia ochreous-whitish, brownish-tinged on basal half, with antemedian series of faint fuscous spots. Hindwings light fuscous, darker posteriorly ; cilia pale whitish-fuscous.

One specimen, Peradeniya, Ceylon, in November (Green).

Phæosaces aganopis n. sp.

♀. 19 mm. Head light ochreous, brownish-tinged. Palpi very long, second joint dark fuscous sprinkled with whitish-ochreous, above with rough projecting whitish hairs, extreme apex whitish, terminal joint ochreous-whitish, anterior edge mixed with fuscous. Thorax light brown. Abdomen grey, apex whitish-ochreous. Forewings elongate, costa moderately arched, apex obtuse, termen oblique, lightly rounded; 2 widely remote from angle, 7 to termen; rather light brown, slightly ferruginous-tinged, with a few scattered dark fuscous scales ; stigmata dark fuscous, plical somewhat beyond first discal : cilia light ochreous, on basal half brownish-tinged. Hindwings pale fuscous, tinged with whitish-ochreous anteriorly, darker towards apex ; cilia pale ochreous.

One specimen, Maskeliya, Ceylon, in August (Green).

CCPROMORPHIDÆ.

When originally describing the genus *Copromorpha*, I suggested that it would probably be necessary to regard it as the type of a new family, and I now think it advisable to give effect to the suggestion. The characters of the family are at present those of the genus; the basal pectination of hairs on the lower margin of cell of hindwings is a peculiar character amongst the *Tineina*, possibly indicating some relationship to the *Tortricina*; otherwise the family has probably most affinity to the *Xyloryctidæ*, though differing in the separation of veins 7 and 8 of forewings, the parallel veins 6 and 7 of hindwings, and the thickened palpi.

Copromorpha pleurophanes n. sp.

♂ ♀. 15-20 mm. Head and thorax ochreous-whitish, thorax sometimes sprinkled with fuscous. Tongue present, very short. Palpi dark fuscous, apex of second joint white, terminal joint ochreous-white with dark fuscous median ring. Antennæ ochreous-whitish, irregularly spotted above with dark fuscous, in ♂ deeply and broadly dentate. Abdomen whitish ochreous. Forewings elongate, posteriorly dilated, costa posteriorly strongly arched, apex rounded-obtuse, termen rather obliquely rounded; cell very narrow; scales on veins roughened, on margins of cell tufted, between veins appearing ribbed owing to their bases being transparent; ochreous-whitish, thinly strewn with small fuscous spots (in Assam example towards dorsum more ochreous and mottled with fuscous); costa irregularly spotted with dark fuscous; several irregular dark fuscous spots on margins of cell, its posterior end more or less suffused with dark fuscous; two or three posterior series of irregular dark fuscous marks on veins: cilia whitish-ochreous. Hindwings ochreous-grey-whitish, with prismatic reflections; cilia pale whitish-ochreous.

Three specimens, Maskeliya, Ceylon, in March (Pole); Margherita, Assam. The difference in antennal structure from the typical species appears only specific.

ELACHISTIDÆ.

Cuphodes dicastis n. sp.

♂. 10 mm. Head, palpi, antennæ, thorax, abdomen, and legs ochreous-white; antennæ simple; anterior tibiæ with a dark fuscous line; posterior legs with a conspicuous small black spot on origin of median spur beneath, and with several cloudy dark fuscous dots above on origin of spurs and apex of tarsal joints. Forewings narrow, gradually long-pointed from near base; ochreous-whitish; cilia ochreous-whitish. Hindwings and cilia ochreous-whitish.

One specimen, taken near Kandy, Ceylon, by myself in December.

Pyroderces selenopis n. sp.

♀. 16 mm. Head and thorax light shining golden-ochreous, face whitish tinged. Palpi whitish-ochreous. Antennæ whitish, lined above and towards base ringed with dark fuscous, towards apex with three dark fuscous bands. Abdomen whitish-ochreous, three basal segments dark brown dorsally. Forewings elongate-lanceolate, long-pointed; brownish-ochreous; a fine incurved transverse whitish line at $\frac{3}{5}$, above middle emitting a short whitish dash anteriorly, towards costa doubled and enclosing a fine blackish strigula, towards dorsum thickened and becoming silvery-metallic, followed by a subdorsal black dot; wing beyond this suffused with pale ochreous-yellow, most strongly in disc; two indistinct whitish costal strigulæ separated by a blackish dot beyond $\frac{3}{4}$: cilia pale brownish-ochreous. Hindwings fuscous, with a transparent patch towards base; cilia light fuscous, becoming pale yellowish on costa towards apex.

One specimen, Pundalu-oya, Ceylon, in February (Green).

Pyroderces magica n. sp.

♂. 9-12 mm. Head shining metallic bronzy-grey. Palpi yellow, anterior edge of terminal joint dark fuscous. Antennæ dark fuscous, with broad white subapical band, basal joint yellow in front. Thorax deep shining coppery-bronze. Abdomen bronzy-grey. Forewings elongate-lanceolate, long-pointed; deep shining brassy-bronze, basal fourth and apical $\frac{2}{5}$ bright deep coppery-purple; fine transverse bluish-white lines at $\frac{2}{5}$ and beyond middle, second interrupted in disc; cilia dark fuscous, base suffused with coppery-purple. Hindwings dark grey, lighter towards base; cilia purplish grey.

Three specimens, Maskeliya, Ceylon, in February (Pole).

Pyroderces spodochtha n. sp.

♂ ♀. 9-10 mm. Head and thorax ochreous, suffusedly mixed with ferruginous. Palpi whitish-ochreous, suffused with deeper ochreous, terminal joint with dark fuscous subapical ring. Antennæ ochreous-whitish, ringed with dark fuscous or blackish, towards apex with three blackish bands with whitish interspaces. Abdomen pale ochreous. Forewings elongate-lanceolate, long-pointed; reddish-ochreous or ferruginous, partially irrorated with fuscous; markings whitish-ochreous, densely irrorated with blackish or dark fuscous, more or less raised in disc; a somewhat oblique fascia about $\frac{1}{4}$; an upcurved streak from dorsum beyond middle obliquely outwards to $\frac{2}{3}$ of costa, continued along costa to near apex: a terminal streak from tornus to apex, usually interrupted in middle: cilia grey, round apex becoming light ochreous, at apex ferruginous, with short dark grey line before tips beneath apex. Hindwings linear, grey, darker posteriorly; cilia light grey, ochreous-tinged.

Sixteen specimens, Kandy, Ceylon, in December and February (Green). Bred freely from larvæ feeding in resinous masses of a lac Coccid, *Tachardia albizziæ* (Green).

Pyroderces scœosema n. sp.

♂. 9 mm. Head ochreous-white, crown dark bronze. Palpi ochreous-white, dark fuscous towards base, terminal joint dark fuscous except on basal fourth. Antennæ ochreous-white. Thorax dark bronzy-fuscous. Abdomen grey, anal tuft ochreous-whitish. Forewings elongate-lanceolate; dark fuscous, slightly purplish-tinged; a white vertical fascia at $\frac{1}{4}$, narrowed towards costa; a rounded-triangular white spot on costa beyond middle, and another on tornus; cilia rather dark fuscous, lighter and greyer towards tornus. Hindwings grey, on undersurface pale yellow-ochreous on basal half; cilia grey.

One specimen, Peradeniya, Ceylon, in December (Green).

Oedematopoda cypris n. sp.

♀. 12 mm. Head shining dark bronzy-fuscous, collar vermilion-red. Palpi light ochreous-reddish, anterior edge and terminal joint internally dark fuscous. Antennæ dark purplish-fuscous, fringed with long scales above from base to near apex. Thorax vermilion-red, mesothorax posteriorly slenderly edged with blackish, metathorax light ochreous-reddish. Abdomen purple-blackish, posterior edge of second segment white. Legs purple-blackish, bristles whitish-ochreous, spurs with two or three præapical bristles. Forewings elongate-lanceolate, costa faintly sinuate, vermilion-red; a small purple-black spot in middle of base; a dark fuscous-purple apical patch, occupying nearly $\frac{1}{3}$ of wing; cilia dark bronzy-fuscous. Hindwings dark fuscous, basal $\frac{2}{5}$ light ochreous-yellowish, division suffused; cilia rather dark fuscous, paler and suffused with pale yellowish towards dorsum.

One specimen, Kandy, Ceylon, in December (Green). Bred from colony of lac Coccid, *Tachardia albizziæ*, on *Theobroma cacao* (Green).

PLUTELLIDÆ.

Pronomeuta n. g.

Head loosely haired; ocelli present; tongue developed. Antennæ $\frac{3}{4}$, in ♂ moderately ciliated, basal joint moderate, without pecten. Labial palpi moderate, curved, ascending, with appressed scales, terminal joint shorter than second, tolerably pointed. Maxillary palpi obsolete. Posterior tibiæ smooth-scaled. Forewings with 2 from near angle, 4 absent, 7 to apex, 8, 9, 10 from near 7, 11 widely remote, from before middle, secondary cell and parting-vein well defined. Hindwings 1, elongate-ovate, cilia $\frac{1}{2}$; 3 and 4 connate, 5 parallel, 6 and 7 rather approximated, 8 free.

Allied to *Yponomeuta*, apparently somewhat earlier in the line of development.

Pronomeuta sarcopis n. sp.

♂♀. 15-18 mm. Head, palpi, antennæ, and thorax whitish-ochreous, suffused with pale fuscous. Abdomen light fuscous-reddish. Forewings elongate, costa moderately arched, apex obtuse, termen nearly straight, rather oblique, rounded beneath; light fuscous or fuscous-ochreous, irregularly strewn with small dark fuscous dots; discal stigmata rather large, dark fuscous; cilia pale brownish-ochreous, tips paler. Hindwings dull fuscous-reddish; cilia fuscous, tips whitish.

Two specimens, Heneratgoda, Ceylon, in November (Green).

Archimaga n. g.

Head with loosely appressed hairs; ocelli present; tongue short. Antennæ $\frac{3}{5}$, in ♂ stout, simple, basal joint short, without pecten. Labial palpi moderate, curved, ascending, second joint thickened with rough scales beneath, terminal joint shorter than second, acute. Mixillary palpi obsolete. Posterior tibiæ with loosely appressed scales. Forewings with 2 from $\frac{3}{5}$ of cell, 3 from towards angle, 8 and 9 out of 7, 7 to costa, 10 from near 7, 11 remote, from beyond middle, secondary cell absent. Hindwings 1, trapezoidal-ovate, cilia $\frac{2}{5}$; 3 and 4 connate, 5 parallel, 6 and 7 stalked, 8 free.

Allied to *Hilarographa*, of which it may be a development.

Archimaga pyractis n. sp.

♂. 16—17 mm. Head brownish-ochreous, sides of crown fuscous, collar edged with ferruginous. Palpi white, basal joint ochreous, second joint ochreous or fuscous above. Antennæ ochreous. Thorax white. Abdomen whitish-ochreous. Forewings elongate, somewhat dilated posteriorly, costa gently arched, faintly sinuate, apex round-pointed, termen deeply and abruptly concave, oblique, rounded-prominent beneath; white, towards dorsum and termen greyish-tinged; dorsum irregularly spotted with dark fuscous suffusion, extending about $\frac{1}{3}$ across wing, largest spot prætornal; six reddish-orange oblique wedge-shaped strigulæ from posterior half of costa, marked with rather dark fuscous on costa, first two larger and more oblique, becoming whitish-ochreous downwards, sixth abruptly angulated and running to apex; produced apical area otherwise tinged with leaden-grey, and marked beneath with a longitudinal ochreous-yellow blackish-edged bar; terminal area tinged with whitish-ochreous; a black præterminal dot in middle, and two towards tornus; cilia whitish-ochreous, basally brown at apex and yellow beneath it (imperfect). Hindwings whitish ochreous, tinged with grey towards tornus, with a præterminal series of faint grey spots, apex yellower; cilia whitish-ochreous.

Two specimens, Maskeliya, Ceylon, in February and March (Pole).

Irianassa n. g.

Head with appressed scales; ocelli present; tongue short. Antennæ $\frac{1}{2}$, in ♂ simple, basal joint short, without pecten. Labial palpi moderate, curved, ascending, second joint with appressed scales, slightly rough beneath, terminal joint short, thick, obtuse. Maxillary palpi obsolete. Posterior tibiæ smooth-scaled. Forewings with 2 from middle of cell, 3 from $\frac{4}{5}$. 4 from angle, 7 to termen, 8 to costa, 9 and 10 from near 8, 11 remote, from middle of cell, secondary cell well-defined. Hindwings 1, ovate, cilia $\frac{1}{5}$; 3 and 4 connate, 5 somewhat approximated, 6 and 7 rather approximated towards base, 8 free.

Allied to *Hilarographa*.

Irianassa sapphiropa n. sp.

♂. 17 mm. Head dark fuscous, with a bright deep blue bar above middle of face, collar and sides of crown pale metallic blue. Palpi fuscous, towards base whitish-fuscous. Antennæ dark fuscous. Thorax greenish-bronze. Abdomen dark fuscous. Forewings elongate, posteriorly considerably dilated, costa posteriorly moderately arched, apex obtuse, termen sinuate beneath apex, hardly oblique, rounded beneath; dark bronzy-fuscous; basal area within a line from $\frac{1}{3}$ of costa to $\frac{3}{4}$ of dorsum suffused with golden-green with strong purple and blue reflections; four curved outwardly oblique pale metallic-blue transverse strigulæ from near middle of dorsum; two pale metallic-blue oblique streaks from costa before middle, white on costa, second much longer, and two others less oblique from costa beyond middle; a pale metallic-blue oblique streak from beneath costa beyond these, almost or quite meeting a short bluish-silvery downward streak from apex; two short streaks from costa before apex first pale metallic-blue, second bluish-silvery ; two vertical purplish-leaden streaks before and beyond tornus, reaching to above middle, partially split or branched ; cilia brilliant purple-coppery round apex purplish-grey with blackish basal line, with white spots on costal extremities of last two streaks. Hindwings dark fuscous, with a paler thinly scaled longitudinal discal patch ; cilia whitish, with dark fuscous basal line, towards apex with a patch of fuscous suffusion.

One specimen, Kandy, Ceylon, in September (Green). Both in structure and type of markings this insect appears to approach the genus *Laspeyresia* in the *Epiblemidæ*, and possibly indicates the origin of that family.

Hilarographa caminodes n. sp.

♂♀. 12-17 mm. Head, palpi, and antennæ varying from ochreous to fuscous. Thorax deep reddish-orange, with three dark purplish-fuscous usually broad stripes. Abdomen dark fuscous. Forewings elongate-triangular, costa slightly arched, apex rounded, termen sinuate beneath apex, rounded, little oblique ; deep reddish-orange ; basal area with three longitudinal dark bluish-leaden-fuscous streaks ; costal edge dark fuscous ; five oblique pale blue-mettalic streaks from costa between $\frac{1}{3}$ and apex, edged with dark fuscous, more or less white towards costa, last two united at apex to form a loop ; dorsal $\frac{2}{3}$ between $\frac{1}{3}$ and termen irregularly striated with dark purplish-leaden-fuscous ; sometimes costal and discal areas much suffused with dark purplish-leaden-fuscous ; a short leaden bar on termen below middle, preceded by a blackish dot ; a wedge-shaped bluish-leaden-metallic dash on subapical sinuation, whitish on termen : cilia fuscous, mixed with dark fuscous, and at apex and on a subapical spot suffused with ochreous-whitish, with a dark fuscous basal line becoming purplish-metallic on middle of termen. Hindwings dark fuscous, darker terminally ; cilia pale fuscous, with dark fuscous basal line.

Ten specimens, Pundalu-oya, Gammaduwa, and Rangella, Ceylon, in February, March, June, and August (Green).

Larva tunnels into fleshy rhyzomes of cardamom plant causing partial abortion of flowering racemes and is a serious pest (Green).

Saptha smaragditis n. sp.

♂♀. 16-17 mm. Head brilliant metallic dark greenish-bronze, sides behind eyes ochreous-yellowish. Palpi shining golden, terminal joint dark fuscous. Antennæ purple-blackish, with a white patch above at $\frac{2}{3}$ from base. Thorax metallic green, more or less coppery on back. Abdomen dark fuscous. Forewings elongate-triangular, costa posteriorly moderately arched, apex obtuse termen straight, rather oblique, rounded beneath ; blackish ; basal area metallic golden-green, sometimes with coppery reflections, its edge straight, running from $\frac{1}{3}$ of costa to $\frac{2}{5}$ of dorsum ; traces of an interrupted line of ground colour within this, near and parallel to outer edge ; beyond this a fascia of ground colour, bisected by a greenish-silvery line, and followed by a white fascia, of which the posterior edge is suffused and connected with an upcurved crescentic patch of white suffusion above middle, and expanded near dorsum ; posterior area evenly sprinkled with silvery-whitish scales ; a silvery-metallic terminal streak, becoming pale-blue on upper half; cilia shining bluish-grey, basal third blackish. Hindwings dark fuscous, lighter towards base; cilia pale fuscous, on upper half of termen whitish, with dark fuscous basal line.

Fourteen specimens, Kandy, Ceylon, in August and September (Green).

Tortricomorpha grammarcha n. sp.

♂. 23-24 mm. Head whitish-ochreous, hairs of crown mixed with fuscous at base, frontal hairs brushed upwards between antennæ. Palpi whitish-ochreous, second joint externally yellow-orchreous, in front fuscous-tinged laterally slightly excurved, terminal joint half second, fuscous. Antennæ fuscous. Thorax brown. Abdomen fuscous, tip whitish-ochreous. Forewings elongate, posteriorly considerably dilated, costa gently arched, faintly sinuate, apex rounded-obtuse, termen rounded, hardly oblique; brown; extreme costal edge yellowish from $\frac{1}{4}$ to middle; base of dorsum suffused with dark fuscous; a short yellow mark on middle of costa from which an obscurely indicated yellowish line proceeds to dorsum beyond middle; an obscure dark fuscous discal spot at $\frac{3}{5}$; a small triangular yellow spot on costa before apex, from which a very faintly indicated yellowish line proceeds to termen below middle; a terminal series of cloudy dark fuscous dots; extreme terminal edge whitish-ochreous: cilia fuscous. Hindwings dark fuscous, lighter towards base; cilia fuscous.

Two specimens, Kandy and Peradeniya, Ceylon, in September (Green).

Tortricomorpha diphtherina n. sp.

♂♀. 22-23 mm. Head whitish-ochreous, crown brownish-tinged, in ♂ with long frontal hairs brushed backwards between antennæ. Palpi whitish-ochreous, in ♂ laterally excurved, terminal joint in ♂ very short, in ♀ half second. Antennæ pale ochreous. Thorax whitish-ochreous mixed with brownish-ochreous or fuscous. Abdomen pale greyish-ochreous mixed with fuscous, in ♂ with median lateral whitish-ochreous tufts brushed upwards to meet above. Forewings elongate, posteriorly considerably dilated, costa gently arched, apex rounded-obtuse, termen rounded, hardly oblique; rather dark fuscous, more or less strewn with brownish-ochreous scales; markings brownish ochreous, obscurely edged with pale yellow-ochreous; a basal patch, sometimes little marked, its edge running from beyond $\frac{1}{4}$ of costa to before middle of dorsum, bisinuate; semioval spots on costa before and beyond middle; an irregular discal patch extending from middle to $\frac{5}{6}$, in ♀ obscured by general ochreous suffusion; a triangular apical spot; some irregular suffused markings towards tornus; a dark fuscous terminal line: cilia whitish-ochreous, brownish-tinged except round apex, faintly barred with fuscous. Hindwings fuscous-suffused with dark fuscous towards termen: cilia whitish-ochreous, with fuscous basal line.

Two specimens, Peradeniya, Ceylon, in January and February (Green).

Tortricomorpha ergasia n. sp.

♀. 20 mm. Head and thorax light ochreous-brown, thorax faintly spotted with a fuscous tinge. Palpi whitish-ochreous, brownish-tinged, terminal joint half second. Antennæ pale brownish-ochreous. Abdomen fuscous. Forewings elongate, posteriorly considerably dilated, costa gently arched, apex rounded-obtuse, termen rounded, hardly oblique; ochreous-brown; base of dorsum suffused with fuscous; a nearly straight somewhat irregular thick fuscous line from beyond $\frac{1}{4}$ of costa to $\frac{2}{5}$ of dorsum; a spot of fuscous suffusion on middle of costa; a curved series of elongate fuscous spots between veins from $\frac{3}{4}$ of costa to tornus: cilia ochreous-brown, tips whitish-ochreous. Hindwings dark fuscous, lighter towards base; cilia whitish-ochreous, with two faint fuscous lines.

One specimen, Peradeniya, Ceylon, in February (Green).

Anticrates n. g.

Head with appressed scales; ocelli present; tongue developed. Antennæ $\frac{3}{4}$, in ♂ moderately ciliated, basal joint moderate, without pecten. Labial palpi moderately long, subascending, with appressed scales, terminal joint shorter than second, pointed. Maxillary palpi rudimentary. Posterior tibiæ loosely scaled above. Forewings with 1*b* furcate, 2 from angle, 7 to termen, 11 from before middle of cell. Hindwings 1, elongate-ovate, cilia $\frac{1}{2}$; 3 and 4 short-stalked, 8 connected with 7 beyond cell.

Not obviously allied to any genus known to me.

Anticrates chrysantha n. sp.

♂. 16 mm Head and palpi deep yellow. Antennæ dark fuscous, basal joint yellow. Thorax dark purplish-fuscous. Abdomen dark fuscous, anal tuft pale ochreous. Forewings elongate, rather narrow, costa gently arched, apex obtuse, termen nearly straight, oblique, rounded beneath; dark purplish-fuscous; markings clear yellow; a very broad fascia about $\frac{1}{3}$, unevenly narrowed towards costa; a triangular prætornal spot, reaching half across wing, and a small costal spot opposite to it: cilia dark purplish-fuscous, round apex pale yellowish on outer half. Hindwings thinly clothed with hairscales, dark fuscous, slightly purplish-tinged; a patch towards base obscurely suffused with whitish yellowish; cilia purplish-fuscous with darker suffused subbasal line.

One specimen, Maskeliya, Ceylon (Pole).

Stachyotis n. g.

Head with loosely appressed scales; ocelli present; tongue developed. Antennæ $\frac{3}{4}$, in ♂ pubescent, basal joint short, with dense pecten of scales. Labial palpi moderately long, subascending thickened with rough scales anteriorly, terminal joint as long as second, pointed. Maxillary palpi short, porrected, scaled. Posterior tibiæ clothed with long hairs above. Forewings with 2, 3, 4 approximated from angle, 5 absent, 7 to termen, 8 and 9 short-stalked, 11 widely remote, from before middle of cell. Hindwings 1, elongate-ovate, cilia $\frac{2}{3}$; 3 and 4 connate, 5, 6, 7 parallel, 8 free.

Perhaps related to the New Zealand genus *Orthenches.*

Stachyotis epichrysa n. sp.

♂. 19 mm. Head white, face sprinkled with grey. Palpi white, second joint greyish-tinged and irrorated with blackish, terminal joint with subbasals median, and apical rings of blackish irroration. Antennæ grey ringed with whitish. Thorax whitish tinged and sprinkled with fuscous. Abdomen whitish-ochreous. Forewings elongate, rather narrow, posteriorly somewhat dilated, costa gently arched, apex round-pointed, termen concave, oblique; white, partially tinged and irregularly irrorated with fuscous, with scattered blackish strigulæ; anterior ⅔ of costa regularly strigulated with blackish; three irregular brassy-golden fasciæ edged with pale fuscous, first subbasal, obsolete on costa, second somewhat before middle, third at ⅔, narrow and more or less interrupted; a small fuscous spot on costa at ⅚: cilia ochreous-orange, externally with three rows of dark purple-fuscous points. Hindwings pale grey; cilia grey-whitish.

One specimen, Maskeliya, Ceylon, in December (Pole).

TINEIDÆ.

Opostega zelopa n. sp.

♀. 5 mm. Head and thorax white. Antennæ light grey, eyecap white. Forewings lanceolate; white; a broad dark fuscous anterior fascia, on costa extending from ¼ to middle, much dilated downwards and on dorsum extending from near base to near tornus, a fine dark fuscous irregular line from ⅔ of costa to termen beneath apex, area beyond this fuscous; a minute black apical dot: cilia light greyish-ochreous. Hindwings light grey; cilia whitish grey-ochreous

One specimen, Pundalu-oya, Ceylon, in May (Green).

Gracilaria perisphena n. sp.

♂♀. 7—8 mm. Head bronzy-ochreous, face white. Palpi white. Antennæ grey. Thorax bronzy-ochreous. Abdomen grey, anal tuft whitish-ochreous. Legs fuscous banded with white, middle tibiæ not thickened. Forewings narrow lanceolate; bronzy-ochreous, sometimes much mixed with dark fuscous; four costal and three dorsal oblique white wedge-shaped streaks, more or less edged with dark fuscous, first costal from before middle, fourth almost vertical, first dorsal from near base, second somewhat beyond first costal, third tornal; a black apical spot: cilia pale grey, at apex with a white hook edged above with a black line and beneath with an ochreous bar. Hindwings and cilia light grey.

Two specimens, Maskeliya, Ceylon, in April (Pole).

Crobylophora staterias n. sp.

♂. 5—6 mm. Head, antennæ, and thorax shining white. Forewings lanceolate; shining white; three oblique slightly converging dark fuscous lines from costa beyond middle, directed towards tornal spot but not reaching it, space between two anterior pale whitish-ochreous; a round dull golden-metallic raised tornal spot, edged laterally with blackish, and anteriorly faintly ringed with pale yellowish; cilia ochreous-whitish, with three fine fuscous lines, innermost dark fuscous. Hindwings and cilia whitish.

Three specimens, Peradeniya, Ceylon, in July (Green). Larva mines large blister-like patches (several larvæ in one blister) in leaves of *Plumbago capensis*, separating the cuticle from the undersurface of the leaf (Green).

Tonza citrorrhoa n. sp.

♂. 16. mm. Head white, loosely rough-haired on crown but not tufted, face pale yellow. Palpi, antennæ, thorax, and abdomen pale whitish-yellow. Forewings elongate, narrow, terminally dilated, costa slightly sinuate, apex round-pointed, termen concave, rather oblique, tornus prominent, round-pointed ; white, with series of pale fuscous transverse strigulæ between veins ; costal half except towards termen, and veins on terminal area suffused with pale brassy-yellow ; margins of cell, and tornal veins dotted with dark fuscous ; minute blackish dots at apex and tornus : cilia whitish, becoming pale yellowish posteriorly, with a dark brownish postmedian line. Hindwings whitish, towards apex yellowish-tinged and with a few grey strigulæ ; cilia white.

Two specimens, Hantane, Ceylon, in March (Green). This is very closely allied to the other known species, but shows slight structural as well as superficial differences. The neuration is misinterpreted in my description of the generic characters when dealing with the Australian *T. purella*, and should be as follows :—Forewings with 2 and 3 stalked from angle and approximated throughout, 4 absent, 5 connate or short-stalked with 2, 6 from middle of transverse vein, 7 and 8 approximated at base or connate, 7 to termen, 9 absent, 10 absent, 11 from beyond middle of cell. Hindwings with 2 widely remote from angle, 3 and 4 short-stalked from angle, 5 from middle of transverse vein, 6 from angle of cell to beneath apex, 7 absent, 8 closely approximated to cell and base of 6, then diverging.

Struthisca n. g.

Head loosely scaled ; ocelli absent ; tongue absent. Antennæ $\frac{1}{2}$, in ♂ bipectinated or plumose to apex, basal joint short, thick. Labial palpi rather or very short, slender, loosely scaled, pointed. Maxillary palpi obsolete. Posterior tibiæ smooth-scaled. Forewings with 1*b* furcate, 7 and 8 stalked or approximated, 7 to apex or costa, 9 absent, 11 widely remote, from middle of cell, secondary cell and parting-veins defined. Hindwings $\frac{4}{5}$, elongate-ovate, cilia $\frac{1}{2}$; 5 absent, 6 and 7 short-stalked or approximated, 8 free.

Type *S. siderarcha*. This genus is a development of *Melasina*, and shows analogous variability of structure, but is easily separable by the absence of a vein in both forewings and hindwings.

Struthisca holoscia n. sp.

♂. 13—15 mm. Head, palpi, antennæ, thorax and abdomen grey ; palpi very short ; antennal pectinations extremely long, $\frac{2}{3}$ of length of antennæ. Forewings moderately elongate, costa moderately arched, apex round-pointed, termen very oblique, slightly rounded ; 7 and 8 stalked ; grey, obscurely mottled with rather dark fuscous : cilia grey, mixed with rather dark fuscous. Hindwings and cilia grey.

Three specimens, Maskeliya, Ceylon, in February (Pole).

Struthisca mesocentra n. sp.

♂ ♀. 13-18 mm. Head ochreous. Palpi very short dark fuscous. Antennæ in ♂ fuscous, pectinations 4 in ♀ pale ochreous. Thorax and abdomen pale greyish-ochreous. Forewings elongate, costa gently arched, apex round-pointed, termen very obliquely rounded ; pale greyish-ochreous, costal edge yellowish-tinged ; a round blackish spot towards dorsum before $\frac{1}{4}$, and one in disc slightly before middle ; a blackish bar from middle of dorsum, reaching nearly half across wing, sometimes incomplete ; a fuscous fascia from costa before apex narrowed downwards and not reaching tornus ; a series of black dots along posterior half of costa and termen : cilia whitish-ochreous. Hindwings light fuscous ; cilia whitish-ochreous.

Three specimens, Kandy, Ceylon, in March (Green).

Struthisca thranitis n. sp.

♂ 15 mm., ♀ 25 mm. Head pale ochreous-yellowish. Palpi short, pale ochreous, mixed with dark fuscous except towards apex. Antennæ pale ochreous, in ♀ mixed with fuscous, pectinations in ♂ 3. Thorax fuscous, patagia in ♂ whitish-ochreous. Abdomen pale ochreous, suffused with fuscous on sides and posteriorly, anal tuft pale ochreous. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen slightly rounded, rather strongly oblique ; in ♂ whitish-ochreous sprinkled with dark fuscous, in ♂ whitish-fuscous coarsely strigulated with dark fuscous ; base of costa dark fuscous ; a straight dark fuscous fascia from beneath costa before middle to middle of dorsum ; a roundish spot of dark fuscous suffusion in disk beyond $\frac{2}{3}$; in ♂ two or three dark fuscous strigulæ towards apex : cilia in ♂ whitish-ochreous, in ♀ whitish-fuscous. Hindwings and cilia light fuscous.

Two specimens, Maskeliya, Ceylon, in March (Pole).

Struthisca siderarcha n. sp.

♂. 15—17 mm , ♀ 22 mm. Head fuscous, crown mixed with pale ochreous. Palpi moderate, pale ochreous mixed with dark fuscous. Antennæ pale ochreous, in ♀ mixed with fuscous, pectinations in ♂ 6, fuscous. Thorax purplish-bronzy-fuscous. Abdomen fuscous. Forewings moderately broad, more elongate in ♀, costa moderately arched, apex rounded, termen obliquely rounded ; in ♂ purplish-bronzy-fuscous, in ♀ metallic bluish-leaden-fuscous, in both sexes coarsely strigulated with dark fuscous ; a moderate dark fuscous fascia from $\frac{2}{5}$ of costa to middle of dorsum ; a dark fuscous bar from costa at $\frac{2}{3}$, reaching half across wing : cilia purplish-fuscous. Hindwings bronzy-fuscous, darker posteriorly : cilia purplish-fuscous.

Four specimens, Maskeliya, Ceylon, in February (Pole).

Melasina Boisd.

Characters extended as follows : Forewings sometimes with 8 and 9 stalked, or 9 and 10 stalked, or 9 and 10 out of 8, or all veins separate. These differences are probably usually available for specific discrimination, but are not always constant even specifically, and the species exhibiting them, which agree well together in other structural characters and superficially, must properly be included in the same genus.

Melasina tetraspila n. sp.

♂. 23—26 mm. Head light ochreous-yellowish, Palpi short, fuscous. Antennæ pale ochreous mixed with fuscous, pectinations 3. Thorax ochreous-whitish, shoulders suffused with fuscous. Abdomen pale greyish-ochreous. Forewings elongate, posteriorly dilated, costa moderately arched, apex rounded, termen obliquely rounded ; 9 and 10 out of 8 ; ochreous-whitish, thinly strewn with fuscous strigulæ ; costal edge suffused with ochreous ; a moderate fuscous spot on base of costa and two on costa at $\frac{1}{3}$ and $\frac{2}{3}$, reaching half across wing, enclosing pale dots on costa ; a fuscous spot on middle of dorsum, reaching $\frac{1}{3}$ across wing : cilia ochreous-whitish, on costa spotted with fuscous. Hindwings pale greyish-ochreous ; cilia ochreous-whitish, basal half more ochreous.

Two specimens, Peradeniya and Koolanda, Ceylon, in June and October (Green).

Melasina autadelpha n. sp.

♂. 22—25 mm. Head light ochreous-yellow, face fuscous. Palpi very short, fuscous. Antennæ pale ochreous, pectinations 1½. Thorax pale fuscous, anteriorly suffused with darker. Abdomen light fuscous. Forewings moderately elongate, rather dilated posteriorly, costa moderately arched, apex rounded, termen obliquely rounded ; 9 and 10 out of 8 ; pale fuscous, indistinctly mottled with darker ; cilia whitish-fuscous. Hindwings pale fuscous ; cilia pale greyish-ochreous.

Three specimens, Koni, Burma (Manders). Very similar superficially to *M. ochrocoma,* but structurally distinct.

Melasina platyzona n. sp.

♀. 18—21 mm. Head whitish-ochreous, sides with a few dark fuscous hairs. Palpi moderate, whitish-ochreous, second joint irrorated with dark fuscous. Antennæ pale ochreous. Thorax pale yellow-ochreous, more or less mixed with fuscous and sometimes with dark fuscous. Abdomen pale ochreous or whitish-ochreous. Forewings moderately elongate, costa moderately arched, apex rounded-obtuse, termen obliquely rounded ; 8 and 9 stalked ; ochreous-white, with a very few scattered dark fuscous scales ; three brownish fasciæ irrorated or suffused with dark fuscous ; first broad, basal, outer edge somewhat oblique ; second broad, from middle of costa to before tornus ; third narrow, terminal, irregular and more or less interrupted : cilia ochreous-white, with a few dark fuscous scales. Hindwings light brassy-grey ; cilia ochreous-whitish, with traces of a fuscous shade.

Four specimens, Peradeniya and Galboda, Ceylon, in August and December (Green).

Melasina energa n. sp.

♂. 20-23 mm. Head pale ochreous, somewhat mixed with dark fuscous. Palpi moderately long, dark fuscous, terminal joint pale ochreous. Antennæ pale ochreous, pectinations in ♂ 5. Thorax pale ochreous mixed with fuscous and dark fuscous. Abdomen pale fuscous, anal tuft pale ochreous. Forewings moderately elongate, costa moderately arched, apex rounded-obtuse, termen obliquely rounded ; 9 and 10 usually stalked ; whitish-ochreous irrorated with fuscous, and strewn with coarse irregular dark fuscous strigulæ, sometimes little marked ; dark fuscous suffusion appearing to form a basal patch, a fascia from $\frac{1}{3}$ of costa to near dorsum beyond middle, an oblique streak from costa beyond middle reaching half across wing and terminating in a darker discal spot, and a subterminal line, but these are all very ill-defined and sometimes little marked: cilia whitish-ochreous with two fuscous shades, outer half barred with fuscous. Hindwings pale fuscous, sprinkled with darker ; cilia whitish-ochreous with two fuscous shades, sometimes very faint.

Ten specimens, Peradeniya, Tangalla, and Yatiyantota, Ceylon, in March, April, and June (Green).

Ereunetis melanastra Meyr.

Twenty-three specimens, Udagama and Peradeniya, Ceylon, in February, March, and November (Green). Bred in plenty from decaying bark of dead *Hevea braziliensis* (Para rubber) in February (Green) ; perhaps, however, like other feeders on dead wood, it may not be particular as to the kind of tree. Originally described from Fiji, and I have it from Funafuti.

Epactris n. g.

Head rough-haired ; ocelli present ; tongue absent. Antennæ somewhat over 1, in ♂ thick, filiform, simple. Labial palpi moderately long, subascending, with appressed scales or somewhat roughened beneath, terminal joint shorter than second, somewhat pointed. Maxillary-palpi several jointed, folded. Posterior tibiæ clothed with long hairs. Forewings with 2 from before angle, 7 to costa, 11 from before middle, secondary cell indicated. Hindwings under 1, ovate-lanceolate, cilia $1\frac{1}{4}$; 2 remote, 3 and 4 approximated from angle, 6 absent.

Allied to *Tinea*, but distinguished by the long antennæ and absence of vein 6 of hindwings.

Epactris melanchœta n. sp.

♂. 12-13 mm. Head blackish-fuscous. Palpi rather dark fuscous. Antennæ whitish-ochreous, basal joint blackish-fuscous. Thorax blackish-bronze, apex of patagia and posterior extremity pale ochreous-yellow. Abdomen pale ochreous. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded ; pale ochreous-yellow ; markings rather dark fuscous ; a thick streak along basal $\frac{2}{5}$ of costa, dilated near base, posteriorly confluent with an irregular antemedian discal spot ; a dorsal mark near base, and a short streak along dorsum before middle ; a spot on middle of costa ; an irregular elongate spot beneath middle of disc ; an irregular subquadrate blotch from costa about $\frac{2}{3}$, enclosing a costal spot of ground colour, and reaching $\frac{2}{3}$ across wing, its lower angles connected with median discal spot and terminal streak respectively ; a narrow streak along termen : cilia whitish-ochreous Hindwings pale grey ; cilia whitish-grey-ochreous.

Two specimens, Maskeliya, Ceylon, in February and March (Pole).

Chrysoryctis synœma n. sp.

♂. 12-19 mm. Head ochreous-yellow. Palpi dark fuscous. Antennæ pale fuscous, darker-ringed. Thorax dark purplish-fuscous. Abdomen bronzy-fuscous. Forewings elongate, rather narrow, costa moderately arched, apex round-pointed, termen extremely obliquely rounded ; shining ochreous-yellow ; a rather narrow dark purplish-fuscous basal fascia ; costal edge slenderly suffused with dark fuscous to near middle ; a more or less undefined fuscous terminal fascia, anterior edge irregular, running from $\frac{4}{5}$ of costa to tornus : cilia pale yellowish irrorated with fuscous and dark fuscous. Hindwings bronzy-fuscous, sometimes posteriorly dark fuscous ; cilia pale fuscous.

Two specimens, Maskeliya and Yatiyantota, Ceylon, in March (Pole, Green). Very closely allied to some of the Australian species of the genus, yet apparently distinct ; it differs from all by the rather narrow dark basal fascia, the Australian species having either a broad fascia or else only the extreme base dark.

Monopis dicycla n. sp.

♂. 11 mm. Head whitish-ochreous. Palpi dark fuscous, tip whitish-ochreous. Antennæ dark fuscous, paler towards apex, basal joint whitish-ochreous. Thorax whitish-ochreous, patagia dark fuscous. Abdomen grey. Forewings lanceolate ; 7 and 8 stalked ; fuscous mixed with dark fuscous ; discal impression paler and thinly scaled, surmounted by a pale ochreous-yellowish mark ; two connected light ochreous-yellow semicircular dorsal spots, extending from near base almost to tornus, not reaching half across wing, with a small dark fuscous spot lying between them beneath discal impression : cilia ochreous-yellow sprinkled with dark fuscous. Hindwings grey ; cilia pale grey.

One specimen, Maskeliya, Ceylon, in February (Pole). Allied to *ferruginella*, Hb.

Monopis tripetala n. sp.

♀. 17 mm. Head white, side tufts dark fuscous with pale ochreous tips. Palpi fuscous, terminal joint pale ochreous. Antennæ pale ochreous. Thorax dark bronzy-fuscous. Abdomen light ochreous. Forewings elongate, rather narrow, costa moderately arched, apex round-pointed, termen oblique, slightly rounded; 6, 7, 8 separate ; dark purple-fuscous ; three semioval ochreous-whitish blotches, first largest, extending on dorsum from near base to middle, and reaching $\frac{3}{4}$ across wing, second extending on costa from before middle to $\frac{3}{4}$ and reaching nearly half across wing, third extending on dorsum from $\frac{2}{3}$ to tornus and reaching $\frac{1}{3}$ across wing : cilia dark fuscous, beneath tornus ochreous-whitish. Hindwings whitish-ochreous suffused with pale bronzy-fuscous ; cilia whitish-ochreous.

One specimen, Peradeniya, Ceylon, in December (Green). Allied to the Australian *M. meliorella.*

Tinea brachychlora n. sp.

♀. 15 mm. Head ochreous-fuscous mixed with blackish. Palpi rather dark fuscous. Antennæ pale ochreous-yellowish, basally mixed with dark fuscous. Thorax pale yellow, anterior third dark bronzy-fuscous. (Abdomen broken.) Forewings rather broadly lanceolate ; dark bronzy-fuscous ; markings pale ochreous-yellow ; a patch occupying basal $\frac{2}{3}$, its edge acutely angulated near costa, beneath this slightly concave ; rest of costa marked with eight short oblique strigulæ ; a slender waved streak along termen, on lower half dilated into a triangular spot : cilia pale ochreous-yellow, at apex with two dark fuscous hooks. Hindwings whitish-grey, more ochreous-whitish towards base ; cilia ochreous-whitish.

One specimen, Maskeliya, Ceylon, in March (Pole).

Tinea pachyspila n. sp.

♂ ♀. 10-14 mm. Head light greyish-ochreous. Palpi and antennæ light fuscous. Thorax light greyish-ochreous, sprinkled with fuscous. Abdomen greyish-ochreous. Forewings elongate, narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded ; light greyish-ochreous sprinkled with fuscous ; a round fuscous spot in disc near base ; stigmata represented by round rather dark fuscous spots, first discal largest, plical beneath and sometimes confluent with first discal, an additional spot beneath and more or less confluent with second discal : cilia pale greyish-ochreous, somewhat mixed with light fuscous towards base, becoming ochreous-whitish towards tips. Hindwings bronzy-grey ; cilia pale bronzy-grey.

Three specimens, Peradeniya, Ceylon, in March (Green) ; but also stated by Mr. Green to be common in every bungalow throughout the island. Larva case-bearing, feeding on flannel, fur, &c., all the year round (Green); case relatively large, fusiform-cylindrical, composed of silk covered with grains of sand and fragments of cinder and brick-dust.

Nemotois corybantis n. sp.

♂ ♀. 13-15 mm. Head in ♂ dark indigo-grey, in ♀ face metallic-grey, crown ochreous-yellowish. Palpi ochreous, hairs dark fuscous. Antennæ in ♂ white, towards base dark fuscous and thickened with metallic-blue scales, in ♀ whitish ringed with dark grey, basal half much thickened, with purple-fuscous scales, uppermost dark fuscous and terminating abruptly. Thorax in ♂ dark purple-bronzy-fuscous, in ♀ bronzy-grey margined with orange. Abdomen dark grey. Forewings elongate, posteriorly dilated, costa moderately arched, apex obtuse, termen rather strongly oblique, slightly rounded ; bright orange ; a short silvery-metallic longitudinal streak from base above middle ; a rather narrow direct fascia of ground colour, in ♂ antemedian, in ♀ median, enclosed by two bluish-silvery-metallic lines, second finely edged anteriorly with dark fuscous, and interrupted by an orange dot above middle ; wing beyond this wholly bright coppery-purple, in ♀ mixed with blackish-fuscous : cilia in ♂ purple-bronzy, in ♀ dark purple-fuscous. Hindwings rather dark purplish-grey, darker and more purple in ♀ ; cilia grey.

Six specimens, Peradeniya and Kandy, Ceylon, in July, August, and December (Green).

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A VISIT TO NARCONDAM.

By

B. B. Osmaston, I.F.S.

Narcondam is a small solitary island situated in the Andaman Sea in Lat. 13°-26′. It is well out of sight of land, the nearest being the Great Cocos and North Andaman Islands, both about 80 miles distant to the north-west and west, respectively.

The island is about seven miles in circumference and the central peak reaches a height of 2,200 feet above the sea.

It rises abruptly out of a deep sea from over 500 fathoms and its origin is certainly volcanic, though there are no signs of a crater or of any recent volcanic activity.

It having been decided that the forest growth in Narcondam should be explored with a view to ascertain whether any of the valuable Andaman Padouk (*Pterocarpus dalbergioides*) occurred there, I gladly availed myself of the opportunity of visiting such an interesting and unfrequented island. I spent five days, October 1st to 6th, camped on the island in company with my friend C. Gilbert Rogers during which time we thoroughly explored a great part of the island, ascending the central peak, as well as circumnavigating the island in a nine foot canvas canoe.

The whole island is clothed more or less densely with forest from coast line to summit. In places the jungle is almost impenetrable ; in others one can move about freely in the dense shade afforded by palms (chiefly *Caryota mitis)* under a lofty canopy of huge forest trees including immense figs but no Padouk or other valuable timber.

Fresh water is not to be found anywhere on the island except at a spot near the north-east corner where there was a small pool in the bed of a stream which however would certainly be dry from November to April. Most of my time was devoted to a study of the birds which, however, I found to be scarce both in species and individuals.

Altogether seventeen kinds were observed, of which at least seven are only seasonal visitors.

The following short account of the birds obtained may be of interest :—

(1). *Rhytidoceros narcondami* (The Narcondam Hornbill).

This Hornbill is, as is well known, peculiar to Narcondam where it was discovered by Hume in 1873. I found it fairly numerous in the high forest which clothes the lower slopes of the mountain down to the coast.

They are both noisy and fearless and from their conspicuous black and white colouration are bound to attract the attention of the most unobservant.

I found them feeding exclusively on figs, and such trees in fruit formed a centre of attraction to the birds who resorted to them from far and near. By standing under such trees any number of shots could be obtained. I secured altogether ten specimens which were carefully skinned and preserved. Five times that number might easily have been shot but I refrained from killing more owing to the rarity of the species. This Hornbill, restricted as it is to an area of under three square miles must be, judging from the number of individuals, one of the rarest, if not the rarest, bird in the world.

At a liberal estimate there cannot be more than about 200 Hornbills on Narcondam.

(2). *Palæornis magnirostris* (The Large Andaman Paroquet).

This Paroquet which is so common in the Andamans is also fairly numerous on Narcondam. It keeps chiefly to the top of lofty trees and is difficult to procure.

The only species of Paroquet previously recorded from this island is *P. tytleri* (The Red-cheeked Andaman Paroquet). I know this species well but neither heard nor saw anything of it—so I am inclined to think a mistake was made and that the only species is *P. magnirostris.*

(3). *Aracnecthra andamanica* (The Andaman Sun-bird).

This little honey-sucker is the commonest bird on the island. It chiefly frequents the coast.

(4). *Myristicivora bicolor* (The Pied Imperial Pigeon).

This fine conspicuous pigeon is fairly common especially near the shore. Mr. A. O. Hume says it is only a seasonal visitor, though on what grounds I do not know. I should not be surprised to find it proved to be a resident.

(5). *Halcyon pileata* (The Black-capped Kingfisher).

I saw only two specimens of this beautiful Kingfisher, so it is presumably rather rare.

(6). *Collocalia innominata* (Hume's Swiftlet).

I saw a number of these Swiftlets hawking flies around the summit of the mountain. They probably breed in the caves along the south coast of the island.

(7). *Lepterodius sacer* (The Eastern Reef-Heron).

This Reef-Heron is fairly common along the coast.

(8). *Haliaëtus leucogaster* (The White-bellied Sea-Eagle).

I saw a pair, as well as a young bird in immature plumage.

(9). *Astur* (?) species.

I saw two small hawks circling around the top of the mountain. They resembled *Astur* in their flight. They may have been merely accidental visitors.

(10). *Chalcophaps indica* (The Bronze-winged Dove).

I shot a single specimen of this dove, the only one I saw. It is apparently very rare.

(11). *Eudynamis honorata* (The Indian Koel).

I heard and saw a good many Koel. They are undoubtedly, as in the Andamans, only cold weather visitors.

(12). *Hirundo rustica* (The Swallow).

Common along the shore and near the summit. Migratory.

(13). *Motacilla melanope* (The Grey Wagtail).
(14). *Limonidromus indicus* (The Forest-Wagtail).
(15). *Strepsilas interpres* (The Turnstone).
(16). *Totanus hypoleucus* (The Common Sandpiper).
(17). *Merops philippinus* (The Blue-tailed Bee-eater).
Winter migrants.

Among mammals I found two species of Fruit Bats. The Nicobar Flying-Fox (*Pteropus nicobaricus*) and another smaller species, as well as a rat which appeared to be semi-arboreal in its habits. Of reptiles *Varanus salvator* (The Ceylon Monitor) was very common, especially near the shore. They use their powerful tails in self-defence, inflicting a nasty blow upon any one approaching them incautiously from behind.

Skinks of various sizes were also very common as well as *Calotes* sp. and a beautiful little green lizard provided with suctorial feet.

We also obtained a snake but no frogs or toads.

The ground was, as is usual on such islands, alive with hermit crabs of all sizes, and large whitish land crabs were to be found in holes at the root of some of the larger trees. Mosquitoes were fortunately very rare owing no doubt chiefly to the absence of fresh water.

I saw a couple of scorpions under fallen wood.

The forest belongs to the tropical evergreen type and some of the trees attain very large dimensions both in girth and height. Figs are very numerous, and it is no doubt largely due to this fact that so large a number of fruit-eating birds can support themselves all the year round on so small an area.

Towards the summit of the mountain the tree growth becomes stunted and the vegetation alters markedly in character, such genera as *Strobilanthes*, *Æschynanthus* and *Begonia* being represented, which recall the flora of the eastern temperate Himalayas.

The temperature at the top of the mountain at midday was 74° in the shade, that at the bottom under similar conditions being 82°.

The view from the top was most impressive, commanding as it does the whole of the island, which is spread out at one's feet, surrounded by the limitless ocean.

THE CULICID FAUNA OF THE ADEN HINTERLAND, THEIR HAUNTS AND HABITS.

By W. S. Patton, m.b. (Edin.), Lt., i.m.s.

(With Plates A, B, C, D, and a Map.)

(*Read before the Bombay Natural History Society on* 31*st Aug.* 1905.)

The following paper is the outcome of a year's study of the Culicidæ of the Aden Hinterland, the notes for which were made when serving with a Native Field Hospital.

One could not help being struck with the large number of men who suffered from a very severe type of malaria, and yet nothing was known about the species of Anopheles that was carrying the malaria parasite. It was this that led me to investigate the matter, studying, more particularly, the Anopheles mosquitoes that are to be found in the District.

As an introduction a short description of the journey from Aden to D'thala, the furthest British Post in the Hinterland, is given, as a very vague idea exists as to where the Hinterland is, judging from the addresses of many letters received there.

The Hinterland can be roughly described as that part of Southern Arabia, outside Aden, under British Protection, stretching from Point Murad, on the Gulf of Aden, inland in a north-easterly direction passing Kataba, the Turkish frontier town, 9 miles from D'thala, to the Great Arabian Desert.

This boundary has already been delimitated and is roughly about 300 miles long; from here the boundary, yet to be mapped out, stretches in an easterly direction reaching the coast north-east of Aden.

After leaving Aden, the first halt is made at Sheik Othaman, where there is a rest camp on the further side of the town. Sheik, 9 miles from Aden, has a population of about 7,000. The country house of the Resident is here, situated in a thickly wooded garden.

The road from Sheik to Bir Said Ali, the next post about 12 miles from Sheik, crosses a sandy desert. It is a very tedious and trying march in the hot weather.

There is a Standing Camp at Bir Said Ali and good drinking water can be obtained from the wells close by.

Salim, 11 miles further, the next halting place, is situated about 200 yards from the Wady es Saghir. It is a most undesirable spot, exceedingly hot and sandy, and is infested with camel ticks, mosquitoes and sand flies.

Next morning, trekking almost due north, the Wady Tiban is met at Silula, after leaving it on the left, the villages of Zaida, Shaka, and Al Anad are passed, from which last, Nobat Dakin, the next post, comes into view.

Nobat, 1,100 feet up, is situated on a spur, about ¼ mile above the Wady Tiban. It is the head-quarters of the lines of communication, consisting of a large Supply and Transport Depôt with a detachment of Native Infantry under a British Officer.

The next march to El Milleh, 14 miles from Nobat, is up the dry bed of the Sailah Bileh for 7 miles, then the track leaves the bed and passes over the hills to El Milleh.

El Milleh, where there is a small blockhouse, is situated on a plain, just above a dry river bed. There is a legend attached to some graves, within a few hundred yards of the camp, that they belong to some sailors who were shipwrecked close by.

El Milleh to Hardeba, is a stage of 12 miles over a good track ; about 8 miles from El Milleh, looking due east, two miles from the path, one sees the Fort of Sulek, the centre of the late Kotaibi Operations.

Hardeba is situated on the Saileh Hardeba, and has a good water-supply from a perennial spring below the Fort. The path onwards to Rhado, the next halt, a nine-mile march, is along a dry bed, which in parts is thickly wooded and rather picturesque for this part of Arabia. It is exceedingly unwise to encamp in the river bed during the rainy season, as mountain torrents swelled by the storms in the mountains above make their appearance without much warning and wash everything before them.

Rhado brings one on the 7th evening to the foot of the D'thala hills and the last march is accomplished by ascending either the Kuraba or the Robart Pass.

D'thala, a plateau 5,000 feet, named after the village, is situated at the foot of the Jehaf Range. The climate is salubrious and compares favourably with Indian stations such as Poona. The weather is bracing from December to March. The rainy season consisting of June, July, and August are delightful months. They are characterized by frequent afternoon thunderstorms, seldom raining continuously but lasting for about two hours. The average rainfall is moderate, amounting to about 20 inches.

After this short introduction, I will take up the detailed description of the various mosquitoes, starting with the Anopheles. The accompanying skeleton map of the Hinterland has the names of the different species marked on it. It is especially intended to show the distribution of the various Anopheles Mosquitoes that are found in the country.

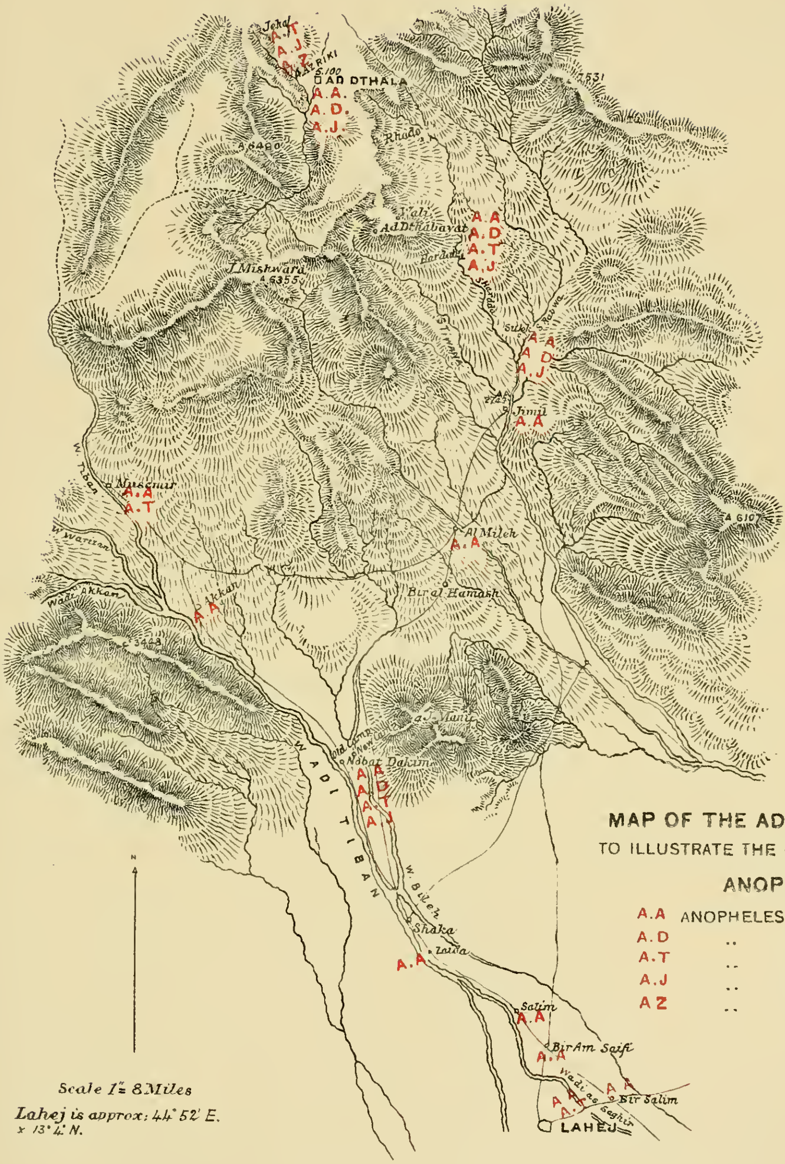
After examining some hundreds of specimens of the five Arabian Anopheles, I came to the conclusion they were distinct species for the following reasons :—

(1) The adult females differ from the descriptions of all the known Anopheles.

(2) The eggs and larvæ are distinct from any that have yet been described.

Thanks to the excellent works of Captain James, I.M.S., Dr. J. W. W. Stephens and Lieut. S. R. Christophers, I.M.S., on the eggs and larvæ of most of the Indian Anopheles, one is able to say a species of Anopheles is a distinct one, if a definite difference between the eggs and the larvæ of any two species can be shown to exist.

It will be noted the five Anopheles are named after different parts of the country, thus enabling anyone to locate these species.


Jehaf
A.T
A.J
A.Z
AZRIKI
5.100
AD DTHALA
A.A.
A.D.
A.J.
6480
Rhado
7531
Vali
Ad Dthabayat
Bardah
A.A
A.D
A.T
A.J
J. Mishwara
6355
Sukl
A.A
A.D
A.J
Jimil
A.A
W. Tiban
Museimir
A.A
A.T
W. Warzan
Wadi Akkan
Akkan
A A
Al Mileh
A.A
Bir al Hamash
A 6107
J. Manif
Nobat Dakim
A.A
A.D
A.T
A.J
WADI TIBAN
W. Bileh
Shaka
Zaida
A.A
Salim
A.A
Bir Am Saifi
A.A
Wadi as Seghir
A A
A A
A A
Bir Salim
LAHEJ
N

MAP OF THE ADEN HINTERLAND.

TO ILLUSTRATE THE DISTRIBUTION OF THE

ANOPHELES.

A.A	ANOPHELES	ARABIANENSIS.
A.D	..	DTHALI.
A.T	..	TIBANI.
A.J	..	JEHAFI
A Z	..	AZRIKI

Scale 1" = 8 Miles

Lahej is approx: 44° 52' E.
x 13° 4' N.

ANOPHELES ARABIENSIS n. sp.

Palpi, three white bands, remainder brown, thorax mouldy with silvery hair-like curved scales. Abdomen brown, covered with dark hairs. Legs banded at all joints.

Female.—Head black, occiput and nape covered with brown upright forked scales. Long curved silvery hairs project over the eyes and clypeus. Scattered over the back of the head there are a few narrow curved and spindle-shaped scales.

Palpi (Fig. 1) are not densely scaled and show three white bands including the apices. The lowest band is about a third of the way up the palpus and is intermediate in size. The central band is the smallest and the apical the broadest. Proboscis brown with yellow apex. Clypeus dark-brown, antennæ are dark with silvery hairs, the basal joint being large and globular.

Thorax light brown, anteriorly there are a few dark, forked and spindle-shaped scales. Scattered over the dorsum there are long and short hair-like curved scales. Prothoracic lobes have a few hairs on them.

Abdomen has no scales on either surface, but long brown hairs.

Wing (Fig. 2) is spotted, with costa showing 7 dark spots, four long and three short. Subcostal vein has two dark spots below the fifth and sixth costal spots. The 1st longitudinal has four black spots, the second is divided into two, sometimes three. The 2nd vein has two black spots on main stem, two on upper and three on lower stem of each branch—often one spot is wanting on each. The 3rd vein has two small patches near its origin and one near its termination—this is most constant. The 4th long vein has two long black spots on the main stem and two on each branch. The 5th has one small spot on the main stem, two on the upper and one on the lower branch. The 6th vein has three spots, one near its origin, one in the centre and one at its termination. The wing fringe is dark with white areas at the junction of all the veins and with a white spot between the junction of the 6th vein and the base of the wing. This spot is sometimes absent.

Legs dark brown with yellowish bands at all the joints. The femur and tibia of the hind leg are speckled, the latter often has a well marked band at its lower end, ungues are simple and equal.

Male.—The upright forked scales are better marked, otherwise the cephalic ornamentation is the same as in the female.

Palpi (Fig. 1) are lightly scaled, the lowest band is the same as in the female, though less distinct. The next band is situated at the junction of the club-shaped apical segment with the lower end, then follows a long white band, then a small black patch, which is sometimes wanting, and lastly the apex is white.

The thorax and abdomen are the same as in the female, sometimes a few spindle-shaped scales are seen on the last abdominal segment.

Genitalia.—Basal segment is curved and globular, covered with brown hairs, apical segment is long and narrow terminating in a point.

Wing ornamentation is the same as in the female. The legs are faintly banded at all the joints. Fore ungues are unequal and uniserrated.

Larva.—Head is black, thorax dark, brown in centre, paler at the sides, abdomen is dark brown. The antennæ have no spine on outer side. Frontal hairs simple and unbranched.

Palmate hairs are present on 2-7th segment inclusive ; there are undeveloped hairs on the 1st segment. The blade is long and dark, the shoulder serrated and the filament long and pointed.

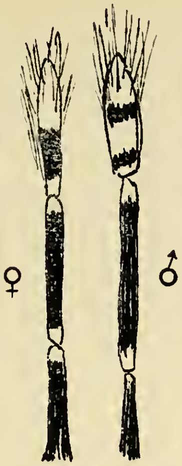
Egg (Fig. 3) is boat-shaped, with a narrow striated frill extending all round the margin of the upper surface. The float is lateral, extending nearly to each end, but nearer the narrower. It does not encroach on the frill. The ova are as a rule laid in the early morning on the surface of some floating object. They are laid in irregular groups and only display star-shaped and other patterns when disturbed by the wind or current.

Habitat and Observations.—*A. arabiensis* has been found from Sheik Othaman to D'thala. It is the common anopheles of the district and is the chief and, as far as the writer can say, the only certain malaria transmitter in nature. It loves breeding in running water and is found in all the small streams and irrigation channels round about Lahej. It has also been found breeding in wells. In most parts of the country water is obtained from deep wells, 40-50 feet below the surface.

Adult females were found in the tents of the rest camp at Sheik Othaman in February 1904 and in January 1905 larvæ were found breeding in the irrigation channels in the garden of the Resident's bungalow. A careful search was made for larvæ in June to September, but neither adult imagines nor larvæ were found. It is most probable that it comes into season early in November and remains till April or May. This almost exactly corresponds with the fever season at Sheik.

The same can be said about Bir Said Ali, where it breeds in the local wells. Many adult females were caught in the tents in February 1905.

It abounds in all the pools and streams around Lahej and Salim, where there is much cultivation. The tents occupied by the sepoys at Salim contained large numbers of this mosquito in September, January and February. Nobat has long been famous for its fever and it was found that this anopheles, though present in the Wady Tiban practically all the year round, is most numerous from March to November. It breeds in the wells at El Milleh during the hot weather. It was found in the wells around Sulek and Ulub ; it was at the latter place in May 1904 that this anopheles was found for the first time breeding in the well near Ulub. The water was stored in tanks in the camp and all precautions were taken from preventing any larvæ from Hardeba being brought to the camp and placed in the tanks. I personally inspected the tanks immediately after the water was brought. Adult females were caught every morning in a tent nearest to the Ulub well (900 yds.). One morning the sepcy in charge informed me some larvæ were brought in the



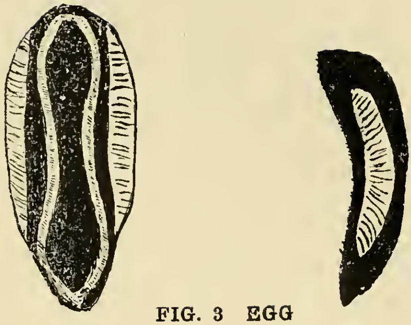
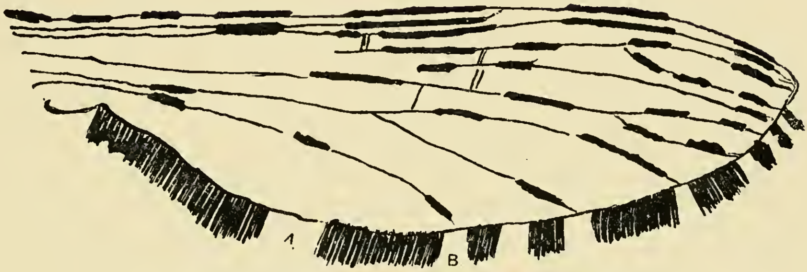


FIG. 3 EGG

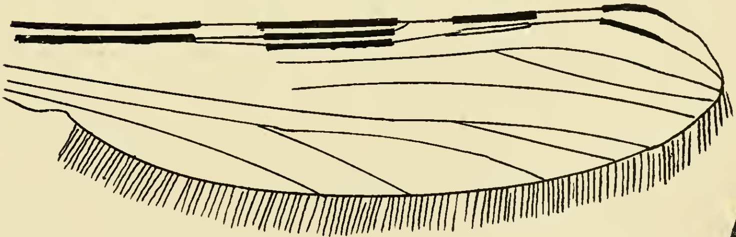
FIG. 1 PALPI

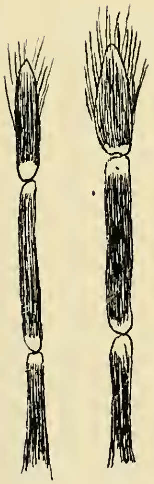
FIG. 2 WING

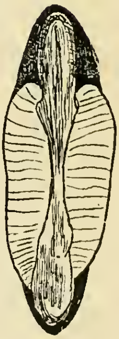


DIAGRAMS OF ANOPHELES ARABIENSIS N. SP.

FIG. 5 WING







LEAF OF PALMATE HAIR

FIG. 6

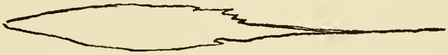


FIG. 4 PALPI

DIAGRAMS OF ANOPHELES DTHALI N. SP.

FIG. 7 EGG

water from the well. The Hardeba water was kept quite separate. This then explained the presence of the few females which were caught every morning.

At Hardeba it breeds in the spring water and many pools which collect in the river bed, chiefly from March to November.

It breeds in all the wells around D'thala from May to the end of October. It was also found in two springs near D'thala. Towards the middle of October at D'thala most of the adults bred out of larvæ were very miniature and I feel certain that if these specimens had been sent to the British Museum for identification they would have been labelled differently. They had hardly any palpal markings and the wing fields were quite pale. This seasonal variation was observed in the earlier part of the year when this anopheles begins to come into season.

It was at D'thala that this mosquito was dissected and sporozoits were found.

When on a short visit to *Am Riga* in the Subahai country this anopheles was found breeding with *Culex pipiens* in brackish water.

This anopheles was never found by me in Aden, but Dr. Young of Sheik Othaman informed me that he once observed an anopheles mosquito at Steamer Point, which was most probably, he thought, *arabiensis.* I am certain this mosquito will be found in the wells both at the Crater and Steamer Point and that it has made its way into Aden from Sheik Othaman. When stationed in Aden a short time I undertook to estimate the endemic index and soon found malaria parasites in children who were born in Aden and who had never been out if it.

This anopheles is closely related to *A. rossii* and *A. ludlowii,* but there are some important differences, which will be seen on comparing them. Specimens of this mosquito were sent to Mr. Theobald in May 1904 and they were said to be *A. wellcomei,* Theobald. Since then I have read the description of *A. wellcomei* in the First Report of the Gordon Memorial College and it is obvious to me that they are not the same. I sent some specimens to Dr. Stephens, saying Mr. Theobald thought they were *A. wellcomei.* He compared them with the type in the British Museum and he informed me they were quite distinct.

Curiously enough though Mr. Theobald informed me that this mosquito was, in his opinion, *A. wellcomei,* yet in a note on *A. pharœnsis* he says, "it also extends into Arabia, having recently been sent me from the Aden Hinterland." This note is obviously meant for *A. wellcomei* as up to that time (September 1904), when the report first appeared, this was the only anopheles I sent to Mr. Theobald. It is hardly necessary to say not a single specimen of *A. pharœnsis* was found by me anywhere in the Hinterland.

ANOPHELES DTHALI n.sp.

Palpi pale with two white bands, thorax light brown covered with curved scales.

Abdomen greenish with darker patches in parts. Legs brown with yellowish bands at the joints.

Female.—Head light brown with many long light brown upright forked scales; clypeus grey, antennæ light brown with light and dark hairs. Palpi (Fig. 4) lightly scaled with two white bands, one at the junction of the middle with the upper third and the second at the junction of the middle and lower third. The apex is dark.

Thorax yellowish brown covered with pale curved hairs and scales. The sides of the meso-thorax are greenish in some lights; scutellum is brown with a few curved scales.

Abdomen, greenish with darker patches, is covered with light brown hairs.

Legs are brown with faint yellow bands at all the joints.

Wing (Fig. 5), the costa has four black spots, the basal spot being the longest. The sub-costal has one black spot near its termination.

The 1st long vein has four black spots corresponding to the four on costa. The remainder of the wing field is pale. The wing fringe is dark. There are no pale patches.

Male is much paler than the female, the upright forked scales on head are more prominent. The palpi are exceedingly pale, there are practically no bands; thorax and abdomen same as in female.

Legs are brown with yellow areas at the joints; fore ungues unequal and uniserrated.

The wing has the same markings as in the female.

Genitalia.—Basal segment medium sized covered with light brown hairs, apical segment narrow, much curved and terminating in a point.

Larva.—Head brown, thorax dark, body almost black with some light mottling.

Frontal hairs are simple and unbranched. Antennæ have a spine on the outer border about midway.

Cephalic ornamentation same as that of *Anopheles tibani* (below). Palmate hairs extend from 1st to 7th segment inclusive with modified hairs on the thorax. The blade is long with no definite shoulders (Fig. 6) and is serrated more on one side than on the other. The filament is as long as the blade.

Egg (Fig. 7) is boat shaped with a narrow striated frill, it is encroached upon by the floats, which are well marked almost meeting in the middle line.

Habitat and Observations.—This anopheles was first found breeding in a spring near D'thala. It was never found in any of the wells around D'thala. At Hardeba it breeds in the spring from October to April. It was found in the tents at Sulek in January 1905 and was breeding in the well 50 yards below the Camp.

This anopheles was also found at the new camp at Nobat, which is 1¼ miles from the river. It was then biting freely and was, I am sure, carrying the malaria parasite, though this was not definitely settled. Specimens of this anopheles were sent to Mr. Theobald, who informed me it was undoubtedly a new species, but related to *Anopheles nili* described in the First Report of

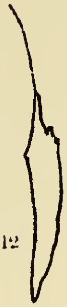


FIG. 12

LEAF OF PALMATE HAIR

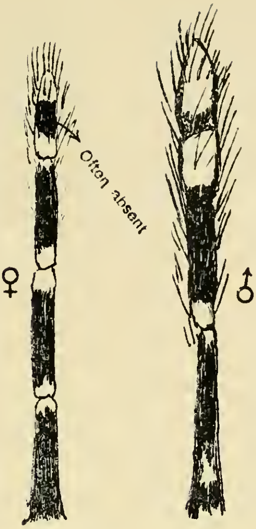


FIG. 8 PALPI

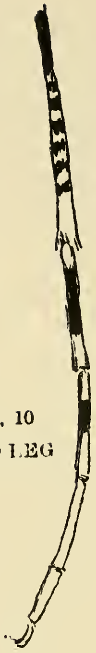


FIG. 10
HIND LEG

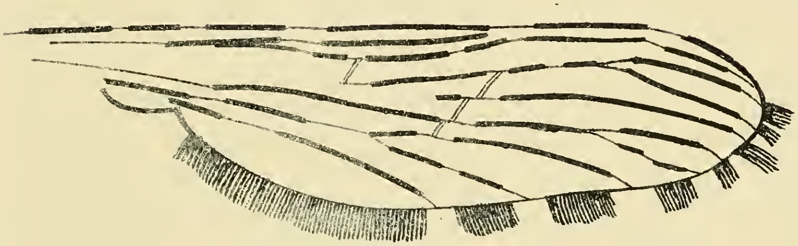


FIG. 9 WING

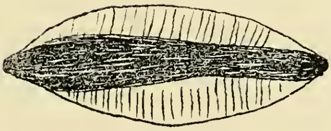


FIG. 13 EGG

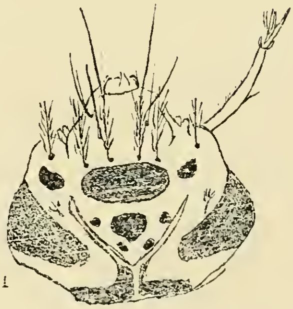


FIG. 11

LARVAL HEAD

DIAGRAMS OF ANOPHELES TIBANI N. SP.

the Gordon Memorial College Laboratory. It can be at once distinguished from *A. nili* by the apical segment of the palpus being black, also by the two white palpal bands.

ANOPHELES (NSSORHYNCHUS) TIBANI n. sp.

Palpi three white bands, sometimes four, remainder black. Thorax black with silvery mottling with many light curved scales. Legs banded, hind leg has 2½-2¾ segments pure white.

Female.—Head black with silvery dots here and there; occiput and nape are covered with black, upright forked scales, scattered about are many white spindle-shaped scales. A tuft of light hairs spread over the clypeus. Palpi (Fig. 8) are black with three white bands including the apex, the bands are arranged as follows:—A narrow white band is situated towards the base, a broader band about the centre and an equally broad band at apex. There is sometimes a narrow black band dividing the apical band into two. Proboscis dark brown and longer than the palpi, clypeus is black. Antennæ dark with light and dark hairs, basal segments are globular and have a few white scales on its inner side.

Thorax.—Prothoracic lobes are black with long light curved hairs, dorsum of thorax is covered with light and dark scales, with many spindle-shaped scales. The dorsum has a general silvery appearance. Scutellum is dark with a row of black bristles and scales. Metanotum is dark, halteres dark with a few minute flat scales.

Abdomen is covered with black hairs, there are a few scales on the last abdominal segment.

Wing (Fig. 9) is much spotted, costa has six dark spots and sub-costal two. The first longitudinal has six spots, the central spot being divided into three. The second vein has two dark spots on main stem, sometimes three and two long ones on each branch. There is sometimes a second spot on lower branch. The third longitudinal has a small basal spot and a long apical one, this latter is occasionally divided into two unequal black spots. The fourth vein has two spots on the main stems with two on the upper and two on the lower branch. The fifth vein has two on the main stem, with two, often three on upper and two on the lower branch. The sixth longitudinal vein has three dark spots. The fringe is dark with light areas opposite the terminations of the veins and their branches.

Legs are black with many white spots; hind leg (Fig. 10) has 2½-2¾ white tarsi, the first tarsus has its lower third covered with white scales, the remainder is black. The metatarsus has a distinct white band at its lower end, this band is most constant, the remainder is speckled. The tibia is spotted and has a distinct black band at its lower end. The femur is black with many white spots. Mid-leg all the tarsi are black, the joints are white metatarsus, tibia and femur black with many white spots. Fore-leg, the two lowest tarsi are black, the second has a well marked and constant white band, the first also has a pale band at its distal end.

Male.—There are many broad upright forked scales on the head, otherwise the cephalic ornamentation is the same as in the female. Palpi (Fig 8) have three, often four white bands, the basal, the smallest is often very indistinct, the central is longer, and the apical the same as in the female, is often divided into two. These are not complete bands as in the female ; antennæ have marked club-shaped ends, which are covered with dark bristles.

Thorax is black with a frosty appearance. The scales are the same as in the female.

Abdomen is black, the last segment alone has a few flat scales on its sides.

Genitalia, medium sized basal segment, apical segment is dark tapering to a fine point.

Wing same as in female, legs also the same, ungues unequal and uniserrated.

Larva.—Head dark brown to black, thorax and abdomen also dark brown. Cephalic ornamentation is shown in Fig. 11. The antennæ have a small spine situated on the outer border ; frontal hairs are simple and unbranched. Palmate hairs are present from 2nd to 7th segment inclusive. Blade (Fig. 12) is long with marked serrations on one of the shoulders, the other has generally one notch. The filament is long and pointed.

Egg (Fig. 13) boat-shaped with long narrow floats which extend almost to both ends. They extend up to the frill which is narrow and not marked. The floats do not approach each other in the middle line.

Habitat and Observations.—This anopheles is found in all the rivers and springs in the Hinterland as far up as Jehaf (6,800 ft.). It only breeds in running water and pools connected with it. It was never once found breeding in any of the wells. It is a wild species and does not come to human habitations. Experiments were made at D'thala to see if the malaria parasite (Benign Tertian) would develope in this species, but a negative result was obtained. Mr. Theobald agreed with me that though it is closely related to *A. theobaldi*, it is a distinct species.

The main differences are as follows: 2½-2¾ hind tarsi are white, while only the last two are white in *A. theobaldi,* the frontal hairs are unbranched and the palmate hairs are only found 2-7th segments, the terminal filament of each blade being long and pointed.

ANOPHELES (MYZOMYIA) JEHAFI n. sp.

Palpi, dark with four bands, thorax brown with many curved hair like scales ; abdomen dark brown, legs brown, pale at all the joints.

Female.—Head dark, occiput and nape covered with broad upright forked scales, on each side of vertex, there are a group of silvery upright forked scales and scattered all over, there are many narrow curved scales. There are a tuft of dark bristles spreading over the clypeus on each side. Antennæ dark, clypeus black. Palpi (Fig. 14) are densely scaled with four white bands, basal band narrowest, central the broadest, the other two are small. The apical band is often very small.

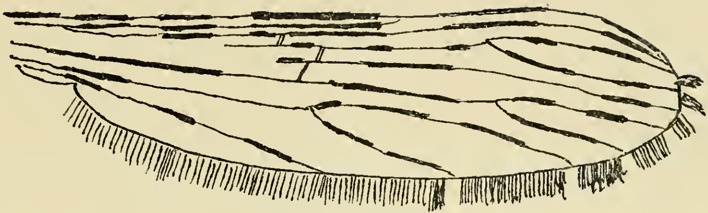


FIG. 15 WING

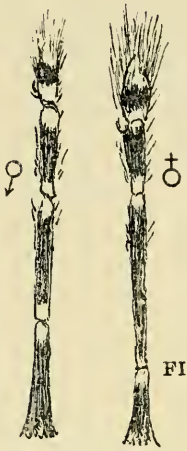


FIG. 14

PALPI

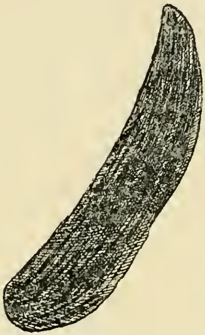


FIG. 17 EGG

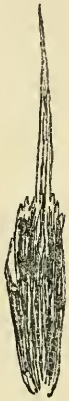


FIG. 16

LEAF OF PALMATE HAIR

DIAGRAMS OF ANOPHELES JEHAFI N. SP.

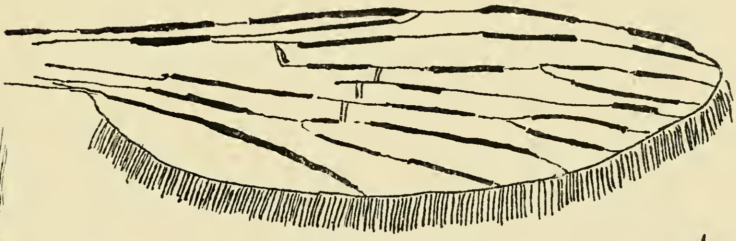


FIG. 19 WING

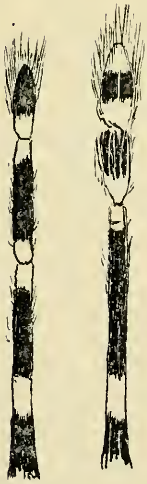


FIG. 18 PALPI

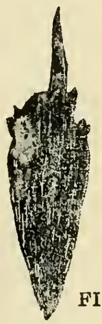


FIG. 20

LEAF OF PALMATE HAIR

DIAGRAMS OF ANOPHELES AZRIKI N. SP.

Thorax dark brown and when denuded of its scales there are three black lines, one central and two lateral. It is covered with brown curved scales with many bristles. Prothoracic lobes are dark with bristles and narrow curved scales. Scutellum has a row of black bristles on upper surface with a few light curved scales scattered about. Metanotum dark with a black line down the centre.

Abdomen is brown with some light patches, there are no scales but many long dark bristles.

Legs are brown with pale areas at all the joints. Fore-legs, the femur are lightly scaled at upper end, the remaining segments are densely scaled.

Wing.—Costa (Fig. 15) has six black spots and three subcostal. The 1st long vein has five spots, sometimes the small central spot is absent. The 2nd vien has three spots on the main stem, two on the upper and two on the lower branch. The 3rd vein has three, sometimes two spots. The 4th has two long black spots on the stem, two on the upper and one on the lower branch. The 5th vein has one spot on its main stem, three on the upper and two on the lower branch. The 6th vein has three black spots. The wing fringe is dark with pale areas at the termination of all the veins except the 6th.

Male.—The cephalic ornamentation is the same as in the female ; antennæ dark and plumose. Palpi (Fig. 14) have four white bands as in the female, the basal band is sometimes absent.

Thorax lighter brown, but has the same scale ornamentation as in the female. Legs are marked the same as in the female.

Abdomen light brown and is covered with light brown hairs. The wing has the same markings as in the female.

Larva is a large one, the head is black and much ornamented. Thorax dark brown, abdomen greenish, fading away to a light brown. Antennæ have no spine on the outer side. Frontal hairs are single and unbranched. Palmate hairs present on the 3rd to 7th segments, inclusive with modified hairs on the 2nd segment. Blade (Fig. 16) long and almost black with light patches at sides, shoulder on both sides has many serrations, the filament is long and pointed.

Egg—·52 mm. in length and ·15 mm. There is no distinct upper surface, no floats and no frill (Fig. 17). The only resemblance that it has to an anopheles egg is, that it is boat-shaped. Each egg is covered with a thin pellicle which easily breaks off. These eggs were found in a spring near D'thala where the larvæ of this mosquito were breeding. They were found on some green matter and were all in a little heap. There was no difficulty in hatching out the larvæ, even though many of the eggs sank.

I instructed my Hospital Assistant, who was on duty at Hardeba, when I first found these eggs to try and obtain some eggs of *Tæniorhynchus tenax* from the spring. I gave him a careful description of the eggs and he sent up what he thought was an egg raft of *T. tenax.* They, however, turned out to be those of this anopheles, they were packed on moist wool and weeds. Most of the eggs sank on attempting to float them. I was surprised after 2½ days to find that most had hatched out. The larvæ were reared and developed into the above anopheles. This egg is the most aberrant type of anopheles egg yet described.

Habitat and Observations.—This anopheles was found in two springs near D'thala, also on Jehaf, hence its name. It was caught in the Hospital tents at D'thala and was breeding in the wells. In December and January it was found breeding in the spring at Hardeba. Some specimens were caught in the tents at Sulek in January. This anopheles has not been found anywhere else. It is a large anopheles and is easily recognised from the other Arabian varieties by the four palpal bands.

Some specimens were sent to Mr. Theobald, who suggested it might possibly be *A. cinereus*, Theobald. *A. cinereus* has been placed by Mr. Theobald in his new genus Pyretophorus but this anopheles undoubtedly falls in the genus Myzomyia. The wing markings will at once separate it from *A. cinereus*. I would like to throw out the suggestion that this mosquito is possibly a malaria transmitter in nature. It was caught in tents and was biting freely. This, however, needs further investigation.

ANOPHELES (MYZOMYIA) AZRIKI n. sp.

Palpi, three bands, apex black ; thorax light brown, abdomen brown, legs dark, no bands.

Female.—Head covered with brown upright forked scales, scattered among these are many brown curved scales. A tuft of light hairs is seen extending over the clypeus on both sides; antennæ are dark, clypeus is light. Palpi (Fig. 18) are lightly scaled, with three white bands, apex is black.

Thorax is brown and covered with brown curved scales and hairs, scutellum is dark, with bristles along its border, metanotum is almost black.

Abdomen is brown covered with light hairs, there are no scales on the abdomen. Legs are brown with pale spots at the joints.

Wing.—(Fig. 19) Costa has five black spots and subcostal two. 1st longitudinal has four spots. The 2nd vein has two on its main stem with two on the upper and two on the lower branch. The 3rd has two spots, one near the base the other at the apical end. The 4th vein has two black spots on the main stems, one on the upper and one on the lower branch. The 5th vein has one black spot on the stem, one short and one long on the upper and two long spots on the lower branch. The 6th vein has one long spot extending almost up to the fringe.

The fringe is dark with no light areas opposite the terminations of the ocius.

Male.—It is much lighter than the female. The palpi often have four pale areas, the apex often being pale. The wing is much lighter than the female, many of the spots are wanting. The legs are brown, fore ungues unequal and uniserrated.

Larva.—A light green larva with amber coloured head. Frontal hairs are simple and unbranched.

Palmate hairs are present on 4th to 6th abdominal segments. Each blade is broad and stumpy (Fig. 20) with serrated shoulders and the filament is a mere spike ; the antennæ have a small spine on the outer side.

The feeding brushes are placed laterally. This larva is exceedingly characteristic. It suspends itself in the water like a culex larva. From the head up to the 2nd segment are submerged.

The egg was not found.

Habitat and Observations.—This species was only found in one spring, the Aziriki spring, near D'thala, where it was breeding in the pools with *Anopheles tibani.* It is a wild species. Mr. Theobald agreed with me that it was closely related to *A. turklandi* Liston. The main differences are as follows :—The costa has five white scaled portions, the 3rd long vein has black spots and the wing fringe has no light areas, but is dark throughout. There is no long branched hair at the end of the antennæ which is well marked in the larva of *A. turklandi.*

I came across this species quite by accident, when studying *A. tibani* a large number of larvæ were collected and examined, this larva was found among them. It is difficult to find if scarce, as it lies up, among green weeds, etc., and seems to have the capacity of remaining a longer time below the surface than the larvæ of the other four species. It is easily frightened. Many attempts were made to procure its eggs, but all failed.

CULEX ARABIENSIS n. sp.

Thorax straw coloured with brown curved scales, with a dark line down the centre and two at the sides. Abdomen brown with apical black bands. Tarsi banded at all the joints, fore ungues unequal and uniserrated.

Female.—Head brown covered with brown upright forked scales, some darker than others, with many narrow brown curved scales ; along the eyes there are black bristles projecting forward and two marked tufts spreading over the clypeus. Antennæ pale in centre and darker at all joints. Palpi dark brown with a small apical white spot, proboscis and clypeus are both dark brown.

Thorax, prothoracic lobes simple with a few dark bristles. Dorsum of thorax is straw coloured, covered with brown curved scales. There are black bristles at the sides ; scutellum is dark with a few narrow curved scales on each lobe.

There are from 7 to 9 bristles on the mid-lobe and four on each lateral lobe ; metanotum is brown.

Abdomen apical black bands consisting of brown broad tile-like scales. Each segment has a large number of brown bristles at the sides and on the dorsum. There are cream coloured tile-like scales on the central surface.

Legs coxæ brown, femora brown but not densely scaled, pale at the tibio-femoral joint. Tibiæ brown with well marked pale band at the tibio-metatarsal joint. Metatarsi densely scaled with a band at both ends. Tarsi are densely scaled with pale bands at all the joints. Fore ungues unequal and uniserrated.

Wing.—Veins have brown scales. Costal, sub-costal and 1st longitudinal are darker than the remainder. 1st sub-marginal cell is nearly twice as long as the 2nd posterior cell.

Male.—Head dark brown with many almost black upright forked scales. The upright forked scales cease at the vertex and are replaced by brown curved scales. Antennæ dark and light with many dark, long plumes, proboscis is dark brown. Palpi (Fig. 21) are brown with a pale band about the centre of the 2nd joint; there is also a pale area at the basal joint. The hair tufts are brown.

Thorax.—Scale ornamentation is the same as in the female, scutelleum is brown with a variable number of bristles.

Abdomen is banded the same as in the female. Male genitalia, basal lobes narrow (Fig. 22), covered with dark hairs, apical segment thin and somewhat club shaped. The wings are paler than those of the female, the legs have the same scale ornamentation.

Larva.—Head globular, with a few branched hairs on dorsum. The antennæ are short with a tuft of hairs on the inner side. The larva is like that of *C. fatigans* Wiedemann. The syphon tube is somewhat narrower.

The eggs and egg-raft are the same as those of *C. fatigans.*

Habitat.—This banded culex was first found in a tank on the plain near Ulub Camp in May 1904. It was breeding in the rain water, that had collected in this tank, with *Stegomyia sugens.* This species was also found in the Crater, Aden. Specimens were sent to Mr. Theobald, who informed me it was a new species of culex.

STEGOMYIA SUGENS Wiedemann (1828).

Auss. Tweiflug. Mxc. p. 545 (1828) Wied. Ann. Soc. Ent. d Fr. S. 4. t. 1 (1863). Rigot (billatus), Bull. Soc. Ent. Ital. p. 257 (1886). Ficalbi (billatus), Mono. Culicid. 1. 300, Theobald (1901).

This mosquito varies a little from the descriptions of the type. After examining some hundreds of specimens it was found that there were always three large white spots on the thorax with a few smaller ones between. Scutellum has three white spots on each lobe.

Male Genitalia (Fig. 23) are exceedingly characteristic and as far as I know have not been described. The basal segment is long and covered with dark hairs, on its inner surface there is a knob-like projection covered with minute hairs.

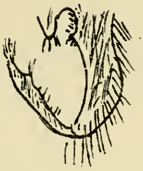
The apical segment is thin and terminates in a flattened boss. From its outer and upper end there projects a long curved hair-like process, which has a blunt termination.

Larva.—Head (Fig. 24) small and black with long curved antennæ. The syphon tube is short.

Egg (Fig. 25) is the same as that of *S. fasciata* described by Daniels.

Habitat and Observations.—This mosquito was first found in the tank near Ulub where it was breeding with *C. fatigans.* It was found breeding on the barrels of water at Nobat. Strange to say it has never been found further up than Ulub. In Sheik Othaman and Aden it is the common mosquito and is a great pest. It breeds in the wells, and wherever water is stored in barrels,

FIG. 22



MALE CLASPER

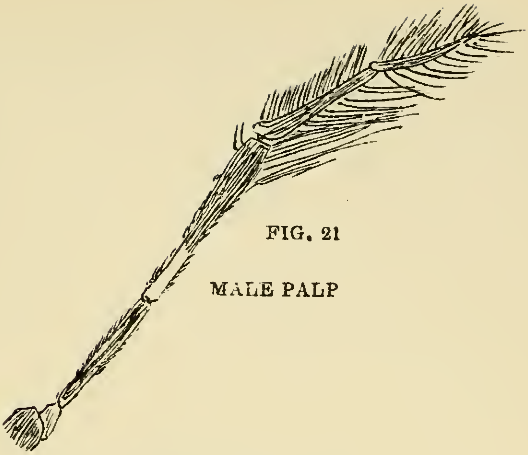


FIG. 21

MALE PALP

DIAGRAMS OF CULEX ARABIENSIS N. SP.

FIG. 23

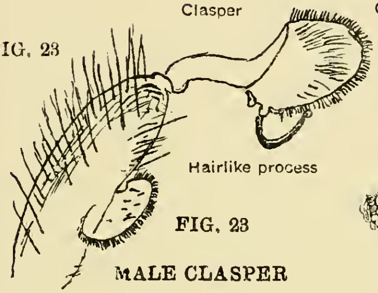
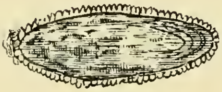

Clasper
Club shaped end
Hairlike process

FIG. 23

MALE CLASPER

FIG 25



EGG

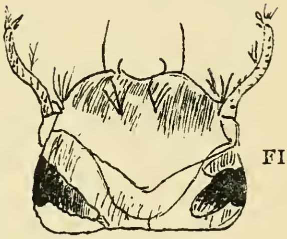


FIG. 24

HEAD OF LARVA

DIAGRAMS OF STEGOMYIA SUGENS WIEDEMANN

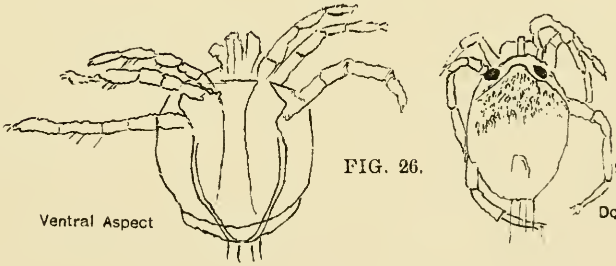

Ventral Aspect
5 Joints
Dorsal Aspect

FIG. 26.

CULICID ACARID

buckets, etc. An attempt was made to try and exterminate this pest in Aden, and what was at first thought to be a simple matter turned out to be most difficult. The eggs are capable of hatching after sinking and it was thus not easy to be sure when emptying a barrel of removing all the eggs. The only sure method was constantly oiling the water, which destroyed the larvæ when they hatched. The bite of this mosquito is most irritating, a large lump being raised in a short time where the mosquito inserted its proboscis. The male of this species does not bite like that of *S. fasciata*. It invariably accompanies the female and will alight on one's body but never bite. It is troublesome in the early morning and at mid-day.

The larvæ are exceedingly active and are able to remain a long time below the surface. It was never found breeding in running water.

TÆNIORHYNCHUS TENAX Theobald.

Banded Arabian variety.

MACULIPES ARABIENSIS. Mono Culicid II, 198 (1901), and III, 258 (1903); First Report Wellcome Research Laboratories, Gordon Wellcome College, p. 78 (1904).

This species is closely related to the type except that the abdomen is very distinctly banded and all the femora have pale basal band. The joints are all banded. The male palpi have four white bands. In all other respects it corresponds with the type.

Larva.—This larva is exceedingly characteristic, it is green and has a long thin syphon tube. It is always found in pools where there is much spirogyra. It rests below the surface among the green strands and is thus most difficult to find. It can remain a long time below the surface only very occasionally coming up for air.

Habitat and Observations.—It was found in the springs at D'thala, and at Hardeba and in the river at Nobat. It is curious that the male of the type was only recently described in the Report of the Gordon College Laboratories. Mr. Theobald agreed with me it was a banded variety of *Tæniorhynchus tenax*, Theobald.

CULEX PIPIENS Linneus.

For Suca (1758) Linneus; Mono Culicid II, 132 (1901) and III, 224 (1913), Theobald; First Report Wellcome Research Laboratories, Gordon Memorial College, p. 76 (1904).

This mosquito was in all the springs and wells about D'thala, also up at Jehaf. It was found at the highest point 7,000 odd feet breeding in pools of rain water that collected in holes in rocks. It is abundant at Hardeba and Nobat.

CULEX FATIGANS Wiedemann.

Auss. Liver. Insect p. 10 (1828) Wied., Mono Culicid II., p. 151 (1901), Theobald, and III, p. 225 (1903).

This is the most common mosquito in the district and is practically found everywhere, breeding in springs, wells and puddles. It was found on Jehaf.

CULEX CONCOLOR Robineau Desboidy.
Memo. d. l. Soc. d'Hist. Nat. de Paris, IV. 408.
Mono, Culicid II., p. 107, 1901 ; III., p. 230, 1903.

This mosquito is the same as *Culex tigripes* Grandpool. (1900). *Tigripes* is a spotted legged variety of *C. concolor.*

It was found only once breeding in an old tank at D'thala containing rain water. It was feeding on *C. fatigans.*

This completes the detailed notes on all the species of Culicidæ found by me in the district. It only remains for me to mention a Culicid acarid which I found parasitic on two species of Anopheles. (*Anopheles jehafi*). Mr. Theobald mentions it occurring on the Egyptian Anopheles. He says "Many of the specimens showed the presence of a parasitic tick attached to them. When alive the parasite resembles a minute preserved cherry. As a rule this parasite is attached to the undersurface of the thorax and abdomen, but it was once found on the wing of an Anopheles." This acarid was also found on *A. arabiensis*. This tiny insect (Fig. 26) measures 25 millimeters and is of a lemon yellow colour. It has six legs and the claws are unequal and uniserrated. I was at first puzzled as to how it attached itself to its host. It struck me it might possibly be on the larvæ and after some hundreds were examined I found one attached to a larvæ just on the outer side of the 1st abdominal segment. I later found two attached to pupa. The specimen on the larva transferred itself from the pupa to the adult mosquito when it hatched out. It was most frequently found on the under surface of the adults close to the head, but I have seen it on the dorsum. On the pupa it fixes itself in the concavity between the abdomen and thorax. I kept many for days in water, but never observed any further development.

I would like to say a few words on the maximum flight of the Arabian Anopheles and also on malaria prophylaxis which may be useful to others.

Since starting the study of the mosquitoes I was constantly making observation on the maximum flight of anopheles. At Nobat in May.1904, I lived in a Staff Sergeant's tent on the ridge, the river was directly below about 450 yards. The wind at night was always fairly strong and from the S.E. Every morning I was able to capture from 6 to 10 female anopheles, (*A. arabiensis*) in my tent and in the tents on the further side about 800 yards from the river, I caught from 50 to 60 every morning. At that time there were many cases of malaria in hospital. The camp at Nobat has now been moved 1¼ miles from the river, there is no water of any description lying between the camp and the river and yet in January 1905 I caught a large number of *A. dthali*. This anopheles was undoubtedly flying this distance to obtain its food, though there was a large Arab village close by. The only explanation I can offer is that as the Arab tents and houses were constantly full of smoke, the mosquito preferred to travel further, where they would not be put to this inconvenience. I need hardly say that though some water was obtained from the river, every precaution was taken to prevent larvæ from being brought into the camp and I could not find a single specimen in any of the barrels. The drinking water was obtained from a pool about 2 miles to the north of the camp. This pool was connected with a spring which here came to the surface when the sand was removed. There were no larvæ here of any description. When at Ulub in May I found *A. arabiensis* always in two or three E. P. tents facing the Ulub well, which was 900 yards away. About 100 yards above the well were two Arab huts, yet this mosquito preferred to come to the tents. I am certain it was the smoke in the tents that kept them away. The Arabs are in the habit of driving the mosquitoes away by a smoking fire.

Now with regard to malaria prophylaxis in the Hinterland. Though I stayed in many of the places where I knew malaria was being contracted, *viz.*, Nobat, Old and New Camps, Ulub and Sheik Othaman, I never contracted malaria, because I used my mosquito curtain with extreme care, invariably fixing it up early and never going to bed without seeing that there were no mosquitoes inside. I only once took three grains of quinine and can only recollect finding *A. arabiensis* four times in my curtains in the morning. I would recommend any one going to the Hinterland to provide himself with a good mosquito curtain fitted on to a camp bed and to use this curtain from Sheik Othaman onwards. He should also observe the following points :—

(1) See that there are no holes.

(2) Have the curtain put up early and be most particular to have all mosquitoes driven out that may have settled on the inside when the curtains were turned up.

(3) To see that there is no entrance left after he has got into bed.

(4) To have a piece of cloth 'let in' (about 8 inches broad), where his arms or legs are likely to touch the curtains when asleep. This is so often forgotten. Camp beds are often cramped for various reasons. It is a good plan to have the rods fixed to the legs and diverging so that the curtain falls away from the bed and allows more space.

(5) Wear putties when sitting out at night. I have seen anopheles (*A. dthali*) at Nobat come into the mess tent at dinner time and fly round the lamp.

(6) Not to hang up dark clothes, as mosquitoes prefer dark objects to rest on.

(7) Keep all trunks and boxes closed as they are often means of conveying mosquitoes from one place to another.

Some one will say, this is so troublesome ; but I think it is worth the trouble. Officers often leave their servants to fix up their curtains and I am sorry to say they are then not of much use. A native does not understand why the sahib takes all the trouble, so it is left till late and by that time mosquitoes are already on the wing and easily enter the net and so escape notice.

In conclusion, I wish to record here my grateful thanks to Mr. Fred. V. Theobald, of the British Museum, for his kind help.

I trust this paper will be of some use to those serving in the Aden Hinterland and that some will be able to fill up the many gaps.

ON THE DISTRIBUTION OF THE VARIETIES OF COBRA (*NAIA TRIPUDIANS*) IN INDIA.

By Lt.-Col. W. B. Bannerman, m.d., b.sc., i.m.s., Director, Plague Research Laboratory, and Assistant Surgeon J. P. Pocha, in charge of the Venom Department, P. R. Laboratory.

(*Read before the Bombay Natural History Society on 6th July 1905.*)

In the year 1901 the Government of India resolved to start the manufacture of antivenene in India, on the lines laid down by Fraser and Calmette, and the first step in this direction was to secure a supply of venom from the various poisonous snakes of the country. A circular ordering the collection of snakes was therefore sent round by the Government of India to the various Local Governments, and as a consequence snakes began to arrive at the Plague Research Laboratory in October 1901. Since that date 1,074 cobras have been collected, and it is proposed in this paper to consider the distribution of the three varieties we have received.

Boulenger in his " Catalogue of the Snakes in the British Museum " thus describes these three varieties :—

A.—Forma Typica (*C. naia*, L. ; *N. lutescens*, *fasciata*, *brasiliensis*, *siamensis*, Laur. ; *C. rufus*, Gmel.).—Yellowish to dark brown above, with black-and-white spectacle-mark on the hood and a black-and-white spot on each side of the lower surface of the hood. 25-35 scales across the neck, 23-25 across the middle of the body.

B.—Var. Cæca (*N. non-naia*, Laur. ; *C. cæcus*, Gmel ; *T. oxiana*, Eichw.).—Uniform pale brown or grey to blackish ; no marking on the hood ; one or more dark cross-bands on the anterior part of the belly ; young sometimes with dark rings. 25-31 scales across the neck, 21-25 across the middle of the body.

C.—Var. Fasciata, Gray (*N. kaouthia*, Less. ; *N. larvata*, Cant., var. *scopinucha*, Cope)—Brown, olive, or blackish above, often with more or less distinct light, black-edged cross-bars ; hood with a whitish, black-edged ring or U, or with a mask-shaped figure ; a black spot on each side under the hood. 25-31 scales across the neck, 19-21 across the middle of the body.

In popular language these three varieties are :—

A—The cobra with spectacle marking on the hood = Binocellate cobra ;

B—The cobra with no such marks=Anocellate cobra; and

C—The cobra with a ring mark on the hood=Monocellate cobra.

Though the number of cobras received is large, it is unfortunate for our present purpose that they have been sent from comparatively few places, and it becomes therefore impossible to give a complete distribution list for India. But a beginning can at least be made, and it is hoped that members of our Society will send us notes to enable a more correct and complete distribution list to be made out at some future time.

A—*Naia tripudians*, var. forma *typica*, appears to be distributed uniformly throughout India but to be rare in Burma and China. As far as our specimens enable us to judge, the prevalence of this variety in the Provinces of India is as follows:—

Madras	100 %
United Provinces of Agra and Oudh	82 %
Bombay	75 %
Punjab	50 %
Bengal	47 %
Central Provinces	26 %

It is the only variety of cobra we have received from the Madras Presidency.

In confirmation of this Nicholson says (Indian Snakes, p. 106):—"This binocellate variety is found in the South of India and on the coast generally." As he says in a footnote that he examined 1,200 cobras in Bangalore, it may be taken as certain that they were all *typica*. From the Bombay Presidency we have received eight snakes only, of which six belonged to this variety. As these were purchased from local snake-charmers, who said they caught them at Matheran or Khandalla, it is impossible to say anything about the distribution of *typica* in Bombay.

Proceeding northwards, we find it uncommon in the western part of the Central Provinces, but again common in the United Provinces. In Bengal it is also common; but it will be noted that 24 of our 80 Bengal specimens came from Puri and may therefore be considered a northward extension of the Madras cobra.

As regards the Punjab, nothing can be said, as only two cobras were received from this province; one being *typica*, and the other *cæca*.

Captain F. Wall, I.M.S., reports that all the cobras he got in Trichinopoly and Cannanore were of this variety, thus confirming our results as regards the Madras Presidency. He also reports one out of 36 specimens from Burma.

Capt. P. Mackie, I.M.S., reports from Goona :—

"In 1904, 45 cobras were examined. They were all quite black in colour. No light one was ever seen. Only a few were examined for ocelli and of all those examined none were found shewing that marking.

"Up to the present date in 1905, 32 more cobras were examined and particular attention was paid to the presence or absence of ocellate markings. All the cobras except two were quite black and possessed no marks on the hood. Two small ones were seen, one of a light khaki colour with well marked 'spectacles' and another cobra about 2½ feet long of a dark greyish colour with very well marked ocelli and another pair of subsidiary round ocelli below at the base of the hood. (This specimen is at the Parel Laboratory.) These black cobras of Goona tend to run to a large size and about 10 per cent. were over 5 feet 5 inches long.

"The ground soil of Goona is of two kinds. On the lower ground in the valleys and on the cultivated land 'black cotton' soil is prevalent lying on a basis of red laterite. This laterite crops up on the higher ground and here is not covered with soil. Nearly all the cobras were caught within a short distance of cantonments and nearly all on the black cotton soil. The two light cobras were also caught on black cotton soil."

Among the black cobras we received from Saugor, there were a few with spectacles, and this seems to show that there is a variety of spectacled black cobra in the West of the Central Provinces and probably also in Central India.

Captain Wall reports 10 specimens caught at Fyzabad, U. P., of which 7 were black or plumbeous—black with binocellate markings; 1 was anocellate black, and 2 were light coloured with markings of such a peculiar nature that he found it impossible to place them in either the binocellate or monocellate group.

B.—Naia tripudians, var. *cæca.*—This variety, which is almost invariably black, seems to have a much more restricted range than *typica.* With the exception of nine, the whole of the 629 specimens received came from the Central Provinces.

The nine exceptions were received from Bengal (3), United Provinces (5), and Punjab (1).

Captain Wall reports 3 specimens all light coloured and one with 7-8 leaden dorsal bands, got by himself in the Swat Valley, and two more from Thayetmyo and Meiktila in Burma.

Probably most of Captain Mackie's specimens were of this variety, though he did not examine the first lot of 45 with special reference to this point, as we found this the case among the black cobras received from the neighbouring Central Provinces.

C.—Naia tripudians, var. *fasciata*.—This variety seems absolutely confined to Bengal and Burma, where it largely takes the place of *typica*. Nicholson, however (p. 106), notes its presence in the Central Provinces also.

Of the 169 cobras received from Bengal, 86 were of this variety, and from Captain Wall's report it would appear that the further east one goes, the more common does *fasciata* become. Thus he says that out of 36 specimens collected by him in Burma, mostly near Rangoon, 33 were monocellate. Again, he says that all the specimens seen by him in Chinese Museums " from the Yangtse Valley and further north " and " from Hongkong and thereabouts " were *fasciata* with one exception, and that was a *sputatrix*, a variety which has not yet been found in India.

To sum up, it would appear that *typica* may be looked for in any part of India, more rarely in Burma and still more rarely in China. *Cœca* is the common cobra of the west part of the Central Provinces and Central India, and has been found also along the frontiers, from Afghanistan, Gilgit, Swat to Sikkim. *Fasciata* is eminently the Bengal cobra, and appears also to be the variety commonly found to the east thereof, in Burma and China.

The above account of the distribution of the varieties of cobra is interesting and worth continuing and enlarging, and I trust the publication of this paper in the Journal may induce members in all parts of India to send notes of the cobras found by them.

What is the meaning of this distribution ? Why should one part of the country produce spectacled cobras and another ringed ones ?

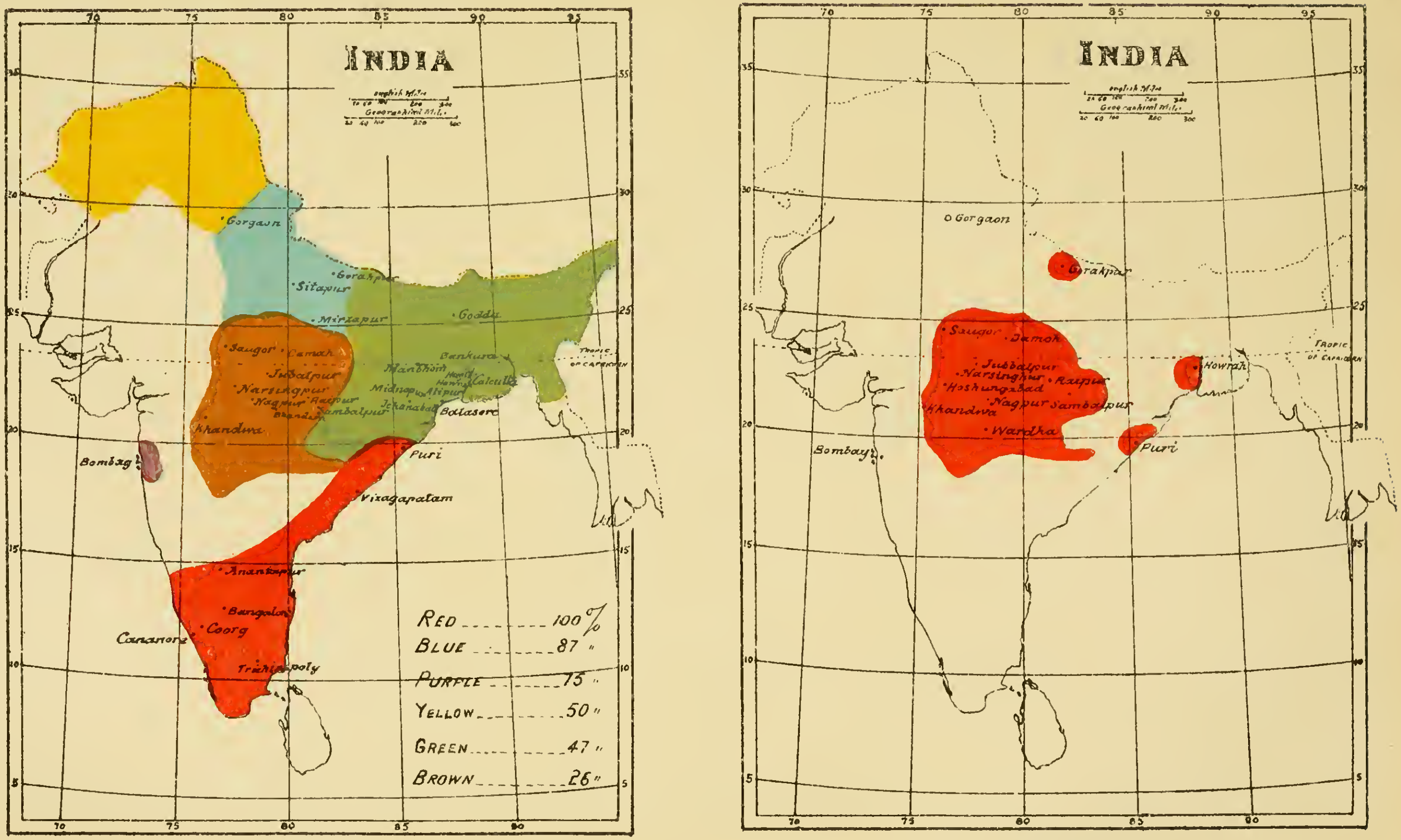
Another curious point raised by this collection of statistics has relation to the body colour of the cobras.

Without exception, all the *cœcas* received from the Central Provinces are black, while all the cobras received from the Madras and Bombay Presidencies are yellow or olive coloured, or a variation between these two shades.

From the map given at the end of this paper, those interested will be able to see exactly from which parts of the Central Provinces these black cobras come; and I should be grateful if any member interested in geology would inform us whether there is anything in the soil of these places likely to favour the production of this colour.

List showing the number of Cobras received at the Plague Research Laboratory, from various parts of India, between 1*st October* 1901 *to* 31*st March* 1905.

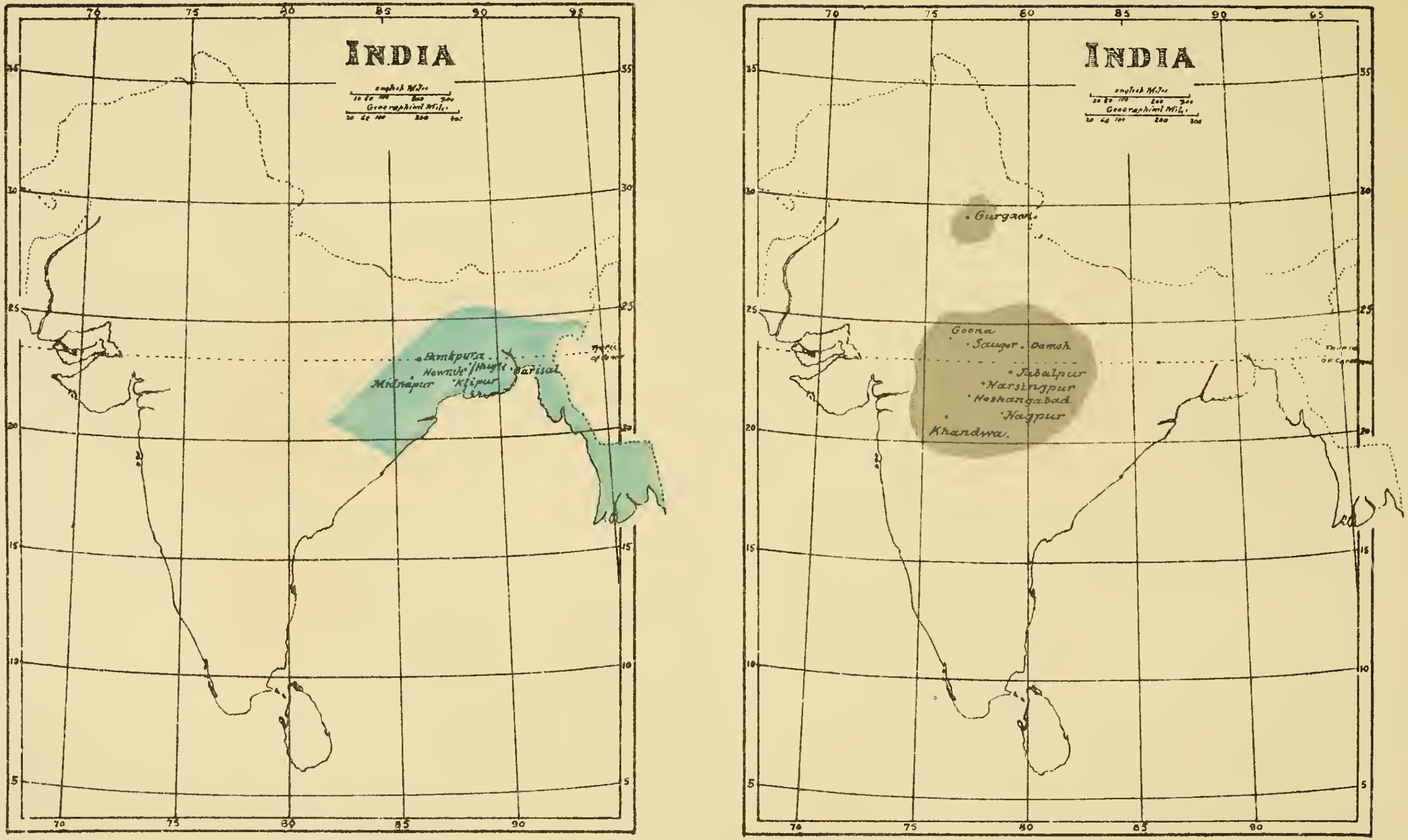
Serial Number.	Name of Town.	KIND OF COBRA.			Total.
		Naia typica.	*Naia cæca.*	*Naia fasciata.*	
		BENGAL.			
1	Alipore	1	...	8	9
2	Balasore	10	...	...	10
3	Bankura	......	...	11	11
4	Barisal	......	...	4	4
5	Burdwan	4	...	...	4
6	Godda	8	...	...	8
7	Hooghly	5	...	5	10
8	Howrah	10	2	9	21
9	Jehanabad	4	...	...	4
10	Jessore	9	...	...	9
11	Manbhum	2	...	...	2
12	Midnapore	3	...	49	52
13	Poori	24	1	...	25
	Total ...	80	3	86	169
	Percentage of each ...	47·3	1·8	50·9	...
		BOMBAY.			
1	Thana	6	2	...	8
	Total ...	6	2	...	8
	Percentage of each ...	75·0	25·0	...	...
		CENTRAL PROVINCES.			
1	Bhundara	1	...	...	1
2	Damoh	9	34	...	43
3	Hoshangabad	...	3	...	3
4	Jubbulpore	28	15	...	43
5	Khandwa	79	469	...	548
6	Nagpur	2	1	...	3
7	Narsinghpur	9	33	...	42
6	Raipur	3	2	...	5
9	Sambalpur	58	12	...	70
10	Saugor	35	50	...	85
11	Wardha	...	1	...	1
	Total ...	224	620	...	844
	Percentage of each ...	26·5	73·5	...	...


INDIA
Gorgaon
Gorakpur
Sitapur
Mirzapur
Godda
Saugor
Damoh
Jubbalpur
Narsinghpur
Nagpur
Raipur
Sambalpur
Khandwa
Manbhum
Bankura
Midnapur
Alipur
Calcutta
Jehanabad
Balasore
Puri
Vizagapatam
Bombay
Anantapur
Bangalore
Coorg
Cananore
Trichinopoly
Tropic of Capricorn
RED 100 %
BLUE 87 "
PURPLE 75 "
YELLOW 50 "
GREEN 47 "
BROWN 26 "
INDIA
Gorgaon
Gorakpur
Saugor
Damoh
Jubbalpur
Narsinghpur
Hoshungabad
Raipur
Nagpur
Sambalpur
Khandwa
Wardha
Howrah
Puri
Bombay
Tropic of Capricorn

TYPICA

CŒCA.

DISTRIBUTION OF VARIETIES OF COBRAS IN INDIA.


INDIA
English Miles
Geographical Miles
Bankura
Howrah
Hugli
Barisal
Midnapur
Klipur
Tropic of Cancer
INDIA
English Miles
Geographical Miles
Gurgaon
Goona
Saugor
Damoh
Jabalpur
Narsingpur
Hoshangabad
Nagpur
Khandwa
Tropic of Cancer
70
75
80
85
90
95
35
30
25
20
15
10
5

FASCIATA

BLACK COBRAS.

DISTRIBUTION OF VARIETIES OF COBRAS IN INDIA.

Serial Number.	Name of Town.	KIND OF COBRA.			Total.
		Naia typica.	*Naia cœca.*	*Naia fasciata.*	
		MADRAS.			
1	Anantapur	3	...	...	3
2	Bangalore	7	...	...	7
3	Coorg	1	...	...	1
4	Vizagapatam	12	...	...	12
	Total ...	23	...	...	23
	Percentage of each ...	100·0	...	...	...
		UNITED PROVINCES OF AGRA, &c.			
1	Gorakpur	11	5	...	16
2	Mirzapur	7	...	...	7
3	Sitapur	5	...	...	5
	Total ...	23	5	...	28
	Percentage of each ...	82·1	17·9	..	...
		PUNJAB.			
1	Gurgaon...	1	1	...	2
	Total ...	1	1	...	2
	Percentage of each ...	50·0	50·0	...	...
				GRAND TOTAL ...	1,074

THE MANGROVE OF THE BOMBAY PRESIDENCY, AND ITS BIOLOGY.

By E. Blatter, S.J.

(*With plates A and B.*)

(*Read before the Bombay Natural History Society on the 31st August* 1905.)

There is scarcely any formation of the tropical vegetation which biologically and physiognomically could be of greater interest than the mangrove. Wherever in the damp parts of the tropics there is a flat and muddy sea-shore, protected against the heavy waves of the tide, we find within the boundaries of high and low water a more or less developed belt of shrubs and trees to which the name mangrove was popularly applied for a long time. It is now generally adopted by biologists to designate that peculiar edaphic formation which in its floral and vecological characters vastly differs from the inland vegetation. Though most of the representatives of the mangrove are widely spread, and, as it were, cosmopolitans, we may, nevertheless, with Schimper,* distinguish a western and eastern mangrove. The former, which occupies the coasts of Western Africa and America, does not exhibit a great variety, being composed of four species only, *viz.*, *Rhizophora mangle* L., *Laguncularia racemosa*, *Avicennia tomentosa* and *Avicennia nitida*. The eastern mangrove covering the coasts of East Africa, Asia, Australia, and Micronesia is represented by the following kinds : Rhizophoraceæ : *Rhizophora mucronata* Lam., *conjugata* L., *Ceriops candolleana* Arn., Roxburghiana Arn., *Kandelia rhedii* W. et A., *Brugniera gymnorhiza* Lam., *eriopetala* W. et A., *caryophylloides* Bl., *parviflora* W. et A. ; Combretaceæ : *Lumnitzera racemosa* Willd., *coccinea* W. et A. ; Lythraceæ : *Sonneratia apetala* Ham., *acida* L., *alba* Smith ; Meliaceæ : *Carapa moluccensis* Lam., *obvata* Bl.; Myrsinaceæ : *Ægiceras majus* Gaertn. ; Rubiaceæ : *Scyphiphora hydrophyllacea* Gaertn. ; Verbenaceæ : *Avicennia officinalis* L. ; Acanthaceæ : *Acanthus ilicifolius* L. ; Palmæ : *Nipa fruticans* Wurmb.

Of the 21 species here enumerated 14 occur in the Bombay Presidency, *viz.*, *Rhizophora mucronata* and *conjugata*, *Ceriops candolleana*, *Kandelia rhedii*, *Brugniera gymnorhizo caryophylloides*, and *parvi-*

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* Schimper : Pflaozengengraphie auf Physiologischer Grundlage, p. 423.

flora, *Lumnitzera racemosa*, *Sonneratia apetala* and *acida*, *Carapa obovata*, *Ægiceras majus*, *Avicennia officinalis*, *Acanthus ilicifolius.* Here I should like to add *Excaecaria agallocha* L. (Euphorbiaceæ), which is not given by Schimper in the above list, but which, with good reason, may find a place amongst the mangrove vegetation.

In the following description of the several plants it is not my intention to give their complete outer morphology, as there is no want of excellent Floras which describe them fully;* but what I propose is to give a general idea of their habit, drawing the attention to those characters only which are necessary for the understanding of their biological peculiarities.

In the broad belt of mangrove, which may be seen in many tidal creeks and back-waters along the coast of the Presidency and chiefly near the shallow mouth of rivers still exposed to the high-water of the sea, there is especially one kind which by its curiously spreading aërial roots can easily be recognized as *Rhizophora mucronata*, also called the "true mangrove." It is a small, evergreen, glabrous tree or large shrub with thick, terete branches, which are marked with leaf-scars all over. The opposite leaves are entire, coriaceous and glabrous, bright green above, paler and dotted black beneath. The flowers, which arise from axillary cymes, have white, thick, and fleshy petals with villous margins, and a pale yellow, coriaceous, glabrous calyx. The ovoid-conical fruit is 1½ in. long and surrounded at the base by the persistent calyx. *Rhizophora mucronata* forms sometimes tangled thickets by the interlacing of its roots, sometimes it is more isolated; but in any case it always occurs on the outer border of the mangrove formation towards the open sea, thus serving as a protective outpost of the less favoured representatives of the same formation. When the tide is out, the ground occupied by the mangrove shows a bluish-black mud, from which innumerable short stems and longer roots arise. The "true mangrove" may easily be distinguished from its neighbours by the long aërial roots which raise the main trunk above the level of its origin and give the tree the appearance of being supported on stilts. These arise from the usually short stem on all sides, growing first for a short distance in a horizontal direction and arching down afterwards into the water. Soon the base of the stem, with its original roots, dies and now the only support to the upper stem and its branches are those stilt-roots which reach a height of 2 to 3 yards, and which, on account of their great elasticity, are the best possible protective system against the continuous dashing of the waves. The tree may be moved forwards and backwards by the force of wind and water, but, ultimately, it will always assume its former position. In this way the aërial roots are like as many strong anchors which would not allow the tree to be carried away even by the wildest play of the waters. We may very often observe that the growing point of such a root loses its vitality, whereas behind the apex a forked root makes its appearance. It is evident that such a change of growth can have a beneficent influence only under the conditions of existence in a soft and muddy substratum. Another means of furnishing the tree with considerable resisting power is the circumstance that not seldom a row of secondary roots breaks through the under surface of the primary aërial root, descends immediately in a vertical direction into the mud, and, by a luxurious branching into roots and rootlets, helps to strengthen the primary root. The most peculiar feature of *Rhizophora mucronata* and also, as regards the essentials, of the other Rhizophoraceæ is the mode of reproduction. If, after the flowering season (August-December), we approach a mangrove vegetation from the sea-side, we are surprised to see, from a distance long, green pods hanging from the branches of the true mangrove; but on closer examination we find that what we naturally took for a fruit is nothing else than the radicle of a comparatively small fruit, which does not exceed 1½ in. in length. Here we have an excellent case of vivipary in the vegetable kingdom, the extra-seminal development of the embryo beginning already while the fruit still adheres to the tree. The hypocotyl, passing posteriorly into the primary root or radicle, perforates without having a resting period, the morphological apex of the pericarp and protrudes into the air reaching sometimes a length of 2 ft. Brandis speaks of 2½ ft., and Haberlandt [*] observed radicles of one yard in the mouth of the Sairomggong River on the Island of Singapore. At the upper end the radicle is about ½ in. in diameter, it grows thicker towards the lower end, with a diameter of 1 in. and more, and tapers into a conical point at the apex (Fig. 1, Plate A). There cannot be any doubt as to the importance of this special shape, because,

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* *Cf.* Cooke's Flora of the Presidency of Bombay.

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[*] Haberlandt: Eine Botanische Tropenreise., p. 186.

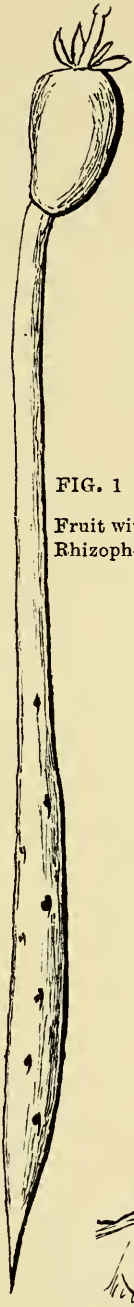


FIG. 1

Fruit with radicle of Rhizophora mucronata.

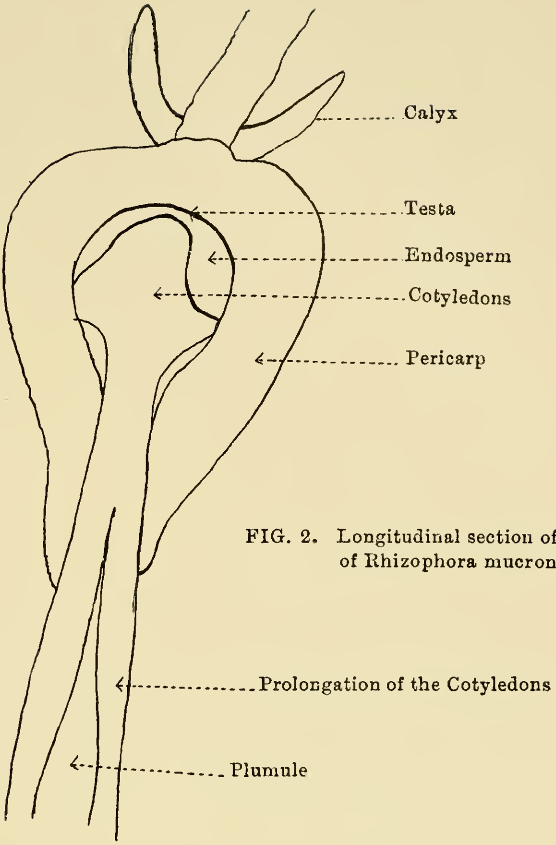

Calyx
Testa
Endosperm
Cotyledons
Pericarp
Prolongation of the Cotyledons
Plumule

FIG. 2. Longitudinal section of fruit of Rhizophora mucronata.

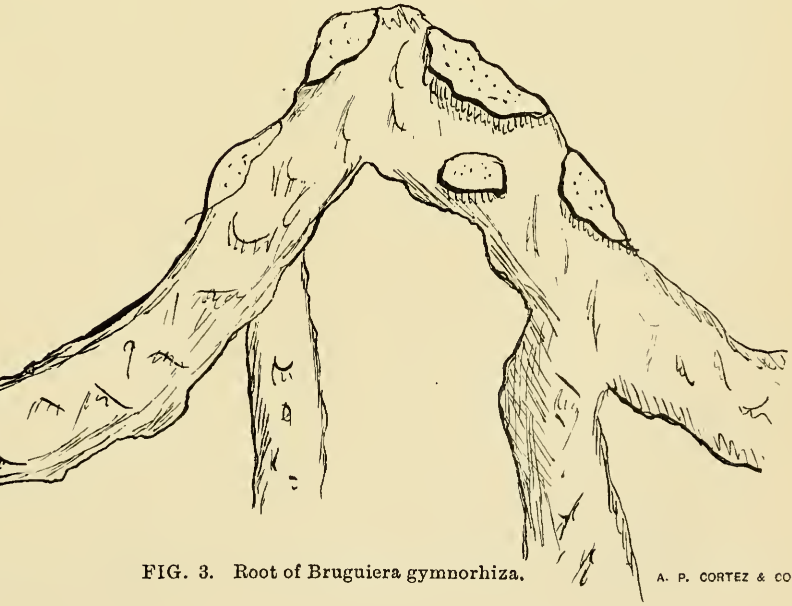


FIG. 3. Root of Bruguiera gymnorhiza.

A. P. CORTEZ & CO.

on account of its club-shaped lower end, the radicle will fall perpendicularly into the mud, and by means of the terminal point it easily bores a hole into the soft substratum, where, after a few hours already, you can find the secondary roots. In spite of this highly practical contrivance the radicles may be found washed up in quantities all along the sea-shore ; but even then they are able to grow roots in any suitable place, because the lower portion of the radicle shows positive and the upper one negative geotropism.

The young mangrove plant is very circumspect during the first period of her detached youth. The epicotyl grows rather slowly in the begining, and it is well that it does so, for a premature development of leaves and branches before the young shrub has formed a strong, resistent root system, adapted to its surroundings, could only end in an early destruction. For the same reason there do not appear any leaves before the stem, consisting of long internodes, reaches the high-water level. As soon as the stem bears branches, there is visible, just above the ground, the formation of the first aërial roots. They do not appear at an earlier period, as there is no need of them, for a thin elastic shoot, being devoid of leaves, does not offer a large surface to the action of the dashing waves. A median longitudinal section of the fruit exhibits some further peculiarities (Fig. 2, Plate A). The two cotyledons are grown together to form a strange structure, the upper part of which is conical and serves, as Haberlandt explains it, as an absorbing organ, through which the embryo receives the necessary food-materials during the rapid growth of the radicle. Behind the conical portion there follows an enlargement of the cotyledons which, most probably, prevents the falling off of the hypocotyl, which in the course of a short time increases rapidly in weight. The continuation of the cotyledons through the micropyle and ca. ½ to 1 in. beyond it is a tubular vagina which surrounds the epicotyl and is at the same time an impediment of the upward growth of the embryo before the radicle falls off.

Another species of Rhizophora which is found in the same localities as the preceding, but is not nearly so common, is *Rhizophora conjugata*. It is a glabrous shrub or small tree with elliptic-lanceolate, coriaceous leaves, dark-green above, paler beneath. The calyx is externally rugose and glabrous, the petals white and glabrous. The conical or obclavate, glabrous fruit is smaller than that of *Rhizophora mucronata*, being only

1 in. long. Its base is surrounded by the reflexed calyx-lobes. The protruding cylindrical radicle reaches sometimes 1 ft. before falling from the tree. As *Rhizophora conjugata* does not reach so far into the sea as *Rhizophora mucronata*, the stilt-roots show, of course, reduction in their development. Besides, I could neither observe that the branches give off aërial roots, as they do in the true mangrove.

The same process of vivipary as observed in Rhizophora takes place in three other plants of the same order, *viz.*, *Bruguiera gymnorhiza*, Lam., *Bruguiera caryophylloides*, Bl. and *Bruguiera parviflora*, W. et A. *Bruguiera gymnorhiza* is an evergreen, glabrous shrub or tree. The entire coriaceous leaves are bright-green above, paler and with a prominent midrib beneath. The petals are setigerous, hairy at the base and glabrous above. The thickly coriaceous fruit is surrounded at the apex by the calyx-lobes, which afterwards drop off. It is obconic and less than 1 in. long. The fusiform, more or less angled radicle, often reaches 1 ft. in length before falling.

Less common, and only occurring in the southern parts of the Presidency is *Bruguiera caryophylloides.* The shrub, branching from the base, bears entire coriaceous leaves, which are pale and shining above, dull and glabrous beneath. The white petals are hairy on the outer side and on the margins. Each lobe of the bifid apex bears 3 to 5 bristles and there is a longer one at the incision. The oblong obovoid fruit is only $\frac{3}{8}$ in. long with a slender, cylindrical radicle of 6 to 8 in. in length.

Also found in salt-marshes but not so common is *Bruguiera parviflora.* Its entire, oblong-lanceolate leaves are coriaceous, shining above, dull beneath. The lobes of the bifid petals bear short hairs at the apex. The fruit, entirely surrounded by the enlarged calyx, is $\frac{3}{4}$ to 1 in. long. The cylindrical, striate radicle reaches 4 to 5 in. before falling.

As to the single phases in the process of vivipary in *Bruguiera,* I had no opportunity to observe the ripening of the radicle. Thus I am not quite sure, whether the hypocotyl alone falls off, leaving the cotyledons and the calyx on the mother-plant or whether the cotyledons, the pericarp, and the calyx follow the radicle. I came to doubt about it after having read a description of *Bruguiera eriopetala* by Haberlandt. This famous biologist was in a position to make careful observations in the garden of Buitenzorg. He found that fruit and calyx were detached at the same moment, and he is of opinion that this circumstance is of prominent importance in the life-history of that species. His reason is this: As the protruding thick radicle grows on the tree to a finger's length only, it happens very often that it does not fall perpendicularly and thus fastens itself only insufficiently or not at all to the muddy substratum. Instead of it several of the numerous and pointed calyx-lobes hide themselves in the mud, and, as they are somewhat curved, fasten sufficiently, the embryo lying horizontally on the ground till the first root is so far developed as to give the plant the necessary resisting power. The secondary roots of the *Bruguieras* are not completely buried in the mud, for after a short or more less horizontal growth, they ascend in an oblique direction to the surface and beyond it, descend again and, disappearing in the soil, leave a knee-like portion exposed to the air (Fig. 3, Plate A.) In *Bruguiera gymnorhiza*, especially the roots grow luxuriously in thickness and height, so as to form round the stem a most curious net-work of brown branches. If we examine under the microscope a transverse section of such a root-piece of *Bruguiera gymnorhiza*, the anatomical structure of the periderm shows very large lenticels. As these are organs which correspond to the stomata of the epidermis and serve to admit oxygen to the living internal tissues, we must consider those roots as a special respiratory system. It is obvious that the muddy substratum is not permeated by too great a quantity of oxygen, we may even say there is a lack of it. It is just for want of this necessary element that the plant was obliged to produce special adaptations to its surroundings, and it did so in a very ingenious and simple way. In *Bruguiera caryophylloides* the usefulness of that contrivance is partially frustrated by the circumstance that the periderm of its roots is gradually cast off. It would be an interesting object of study to investigate the reasons thereof and to find out what the effects are in consequence of it, or whether, perhaps, there arise new adaptations in other parts of the plant.

In the tidal swamps along the coast there are two further species of Rhizophoraceæ: *Ceriops candolleana,* Arn. and *Kandelia rheedii,* W. et A.

The former is a glabrous shrub or small tree, reaching a height of 3 to 6 ft. The opposite, entire leaves are coriaceous and glabrous. The petioles are rugose and glabrous. The calyx-lobes are coriaceous. The white glabrous petals are furnished at the apex with 3 short, clavate bristles. The slightly conical, coriaceous fruit is ½ to ⅝ in. long. The deeply grooved and angled radicle, reaching sometimes 1 ft. before falling, thickens gradually to near the apex and then becomes acute. The cotyledons are conferruminate.

Kandelia rheedii is a small tree with terete leafy branches. The opposite, oblong, entire leaves are dark green and polished above, reddish-brown beneath. The long calyx is externally rugose. The lobes of the bifid petals are divided into numerous capillary segments. The obclavate, conical-ovoid fruit is coriaceous, and reaches a length of ½ to 1 in. The protruded, cylindric radicle is 6 to 15 in. long, usually without ridges or grooves.

In these two plants germination takes place in the same way as in the foregoing Rhizophoraceæ. A special adaptation to the surroundings of *Ceriops candolleana* are the so-called pneumatophores. But as these occur not only in Ceriops but also in other representatives of the mangrove-formation, I shall treat of them after having given a short description of the following three plants:

Abundantly growing in the salt-marshes in Bombay, the Konkan and elsewhere, often covering large tracts of tidal or flooded sea-shore to such an extent as to exclude every other plant, is a shrub or dwarf tree, *viz.*, *Avicennia officinalis*, L. or the "white mangrove."

The entire, oval-pointed leaves are nearly veinless, coriaceous, shining above, whitish below and clothed with a fine tomentum. The broad, compressed capsule is one-seeded and dehisces by two thick valves. The embryo of the erect seed is imperfectly covered by its two integuments. The large cotyledons are lengthwise plaited. The large embryo begins to germinate in the fruit before it falls.

Rather rare is *Sonneratia apetala*, Ham. (Lythraceæ). It is a pretty slender tree, reaching a height of 40 ft. The slender, drooping branches bear entire, coriaceous, glabrous leaves. The calyx is thickly coriaceous. The depressed globose capsule is about ¾ in. broad and supported by the persistent calyx. The many-curved, angular seeds are imbedded in pulp. The short, foliaceous cotyledons are convolute, the elongate radicle terete. This beautiful tree may be found *v.g.*, between Bombay and Sewree and also in Mumbra and Dharamptar.

More common is another species of the same genus—*Sonneratia acida*, L. The small tree, which rarely reaches a height of 15 ft., occurs on the Island of Salsette, in Ratnagiri, Vingorla, Hareshvar, Dharamtar, Kanara. Its elliptic-oblong or obovate leaves are coriaceous and nearly sessile. The coriaceous calyx is borne on a very short, thick pedicel. The cushion-shaped fruit is 1 to 2 in. in diameter. The cup-shaped, persistent calyx bears the persistent base of the style, which is about 1 in. long.

An interesting feature of *Avicennia officinalis*, *Sonneratia acida* and *Ceriops candolleana* are the pneumatophores, which exhibit an aspect widely different from those of the *Bruguieras*. As soon as the shrub reaches a certain height, in *Avicennia officinalis*, *v.g.*, 1 ft. or 1½, there appear in great number around the stem within a rather large circle erect shoots with a soft, elastic texture like cork. They resemble very much the young shoots of Asparagus, except in colour, which, in our case, is a brownish black. They are very seldom observed developing leaves and growing up into bushes. If we follow them downwards we find the point of origin to be the subterranean roots of *Avicennia officinalis*, of which they are the negative-geotropic branches. In this plant they reach 1 to 1½ ft. above the mud or the shallow water and do not exceed in thickness ½ or ¾ of an inch, whereas in *Sonneratia acida* they reach 18 to 24 in. in length, by 3 in. in diameter. As they do not develop into a shrub it is evident that they serve some other purpose. A transverse section of such a root-branch gives us the looked-for explanation. In *Avicennia officinalis* our attention is drawn to a large, white ring which occupies nearly the whole plane of the section, leaving room only for a small, darker ring in the centre and a comparatively disappearing, protective skin. The white, loose portion is easily recognised as the parenchymatous tissue of the primary cortex and in it the naked eye is able to distinguish little holes which, by microscopic examination, prove to be lenticels. Those roots, therefore, represent respiratory organs like the over-ground roots of *Bruguiera*. But why do the pneumatophores reach beyond the water-level, as there is oxygen in the water ? We must admit that the air dissolved in water shows, on the one hand, a higher percentage of oxygen than the atmosphere, but, on the other also a higher percentage of carbonic acid. In consequence of it the quantity of oxygen available to the plant is much smaller in the water than in the air. Besides, the air diffuses very slowly in water and thus it may easily happen that the slow movement of the water causes a want of oxygen. It is for this reason that woody plants, the stem-bases and roots of which are submerged in mud and stagnant water, are furnished with special adaptations for the absorption of oxygen from the atmosphere. That there are really graduations as to the percentage of oxygen available to the plant in different media, may be shown to evidence by the examination of a pneumatophore of *Avicennia officinalis*. The respiratory root is very thin at the base, where it is covered by mud ; it grows thicker, where it is submerged in water, and it reaches its maximum, where it is surrounded by the atmosphere. And if we examine the anatomical structure, we find that the various degrees of thickness are due to the respective development of the parenchymatous tissue, which contains the lenticels, *i.e*, the respiratory organs. The same may be observed in the species of Rhizophora. They are not possessed of special pneumatophores, but the modified tissue of their "stilt roots" takes upon itself the function of respiration, and here again it is not the portion buried in the mud, but the one emerging from the mud and still more the upper part which is accessible to the atmosphere.

Along the muddy sea-coasts of the Konkan grows *Carapa obovata*, Bl. (Meliaceæ), a small glabrous tree. The abruptly pinnate leaves are 3 to 6 in. long with oblong-ovate, glabrous, coriaceous leaflets. The fruit has the size of an orange, 3 to 4 in. in diameter. When young it is apiculate. The fleshy pericarp dehisces by four valves. The angular seeds are surrounded by a hard spongy testa.

The pneumatophores of this plant show great resemblance to those of the *Bruguieras;* but, whereas in the latter we have those knee-like structures and, consequently an up-and downward growth of the roots, we observe that the roots of the former creep horizontally just under the surface of the muddy substratum and send above the surface of it a wedge-shaped expansion of the upper half-cylinder, which, on the top, is covered with a great number of lenticels.

In the South Konkan along salt-water creeks and backwaters a tall glabrous shrub or small tree makes its appearance, *Lumnitzera racemosa*, Willd. Its entire or slightly crenate, sessile leaves are fleshy, coriaceous and crowded at the ends of the branches. The glabrous calyx of the sessile flowers has the teeth ciliolate. The ovoid, glabrous fruit is ½ in. long with longitudinal striæ when dry and the persistent calyx-tube at the top.

A handsome shrub with laurel-like appearance and growing in salt-marshes, together with the different kinds of mangrove, is *Ægiceras majus*, Gaertn. (Myrsinaceæ). The cylindric branches bear obovate, entire, coriaceous leaves. The umbels of the pure white fragrant flowers are sessile. The cylindric, acute fruit, resembling a miniature curved carrot, is coriaceous, striate, and one-seeded. Dehiscence is longitudinal. The seed is curved in the same way as the pericarp. The inferior radicle is long and enlarged at the base. The cotyledons are very small. *Ægiceras majus* shows vivipary, though not in the complete form of the Rhizophoraceæ. The seeds begin to germinate while still included in the pericarp, wherefore Linnæus gave it the name of *Rhizophora corniculata.*

The rather gloomy looking salt-marshes are often beautified by a handsome little shrub, *Acanthus ilicifolius,* L., which on account of its holly-like leaves was called sea-holly. The cylindrical, glabrous stems, rarely exceeding the height of 4 ft., are scarcely branched. The large oblong-oval or oblong-lanceolate leaves have the base acute, the apex acute or truncate. On each margin there are a few large, spinous teeth, continuations of the lateral veins. Besides, they are coriaceous, rigid and shining. The blunt, apiculate capsule, about 1 in. long, is shining and bright-brown. It is in this invariable undergrowth in the mangrove-swamps that we meet again those characteristic stilt-roots of *Rhizophora mucronata,* though not in the same luxurious form. There is no vivipary in the sea-holly ; nevertheless, a peculiarity as regards reproduction is observed in *Acanthus ilicifolius*, *viz.*, a greater development of the embryo while still inclosed in the pericarp than is usually the case with inland plants.

We come to the last representative of our mangrove, *viz.*, *Excœcaria agallocha*, L., called Blinding tree in India on account of the fresh sap being extremely acrid. The small tree bears rather thick branchlets, marked with leaf-scars. The leaves are entire and rather thick. The catkin-like male spikes are numerous. The sessile male flowers are surrounded by acuminate bracts. The more slender female spikes are not so numerous. The capsule, very variable in size, is ½—nearly 1 in. in diameter. The blinding tree, occurring in tidal estuaries and backwaters, is not common.

If we compare with each other the different species which make up the mangrove formation, one fact before all is most striking, *viz.*, that all are possessed of coriaceous leaves. These, again, have a shining surface and their margins entire, with the only exception of *Carapa obovata* which bears pinnate leaves. If we further examine the internal structure of the leaves, we meet the same uniformity as regards their anatomy.

Fig. 1, Plate B, shows a small portion of the under surface of a leaf of *Rhizophora mucronata.* The epidermis, which is composed of a single layer of cells, is on the inside distinctly marked off from the neighbouring tissue. The outer walls of the epidermal cells are considerably thickened and even the side-walls show some thickening. Though the guard-cells always have their walls thickened in a peculiar way, they attain a still higher development in this direction in *Rhizophora mucronata.* The outermost layer of the external walls being in our case exceedingly well developed, covers as a cuticle the whole surface of the epidermis, leaving open small passages only for transpiration. The respiratory cavities, which communicate directly with the intercellular spaces of the spongy parenchyma, are comparatively small. A complete transverse section would show that the number and area of those intercellular spaces is greatly reduced.

Fig. 2, Plate B, exhibits a small portion of a transverse section of a leaf of *Sonneratia acida*, showing the epidermis with stomata. The epidermis is strongly cuticularised, even the side-walls of the epidermal cells exhibit greater cuticularisation than those of *Rhizophora mucronata.* The stomata, which are somewhat raised in the foregoing figure, are here on the same level with the epidermal cells and thus under the horizontal band of the cuticula.

Sometimes one may observe near the sea-shore that individuals of the same species grow in the salt water as well as in the common soil. The comparative anatomy of their leaves shows the special adaptations to the respective substratum far clearer than does the comparison between plants belonging to different species. Fig. 3, Plate B, gives the diagrammatic view of the transverse section of a leaf of *Sonneratia acida* growing in salt mud, and Fig. 4 that of the same growing in common soil. In Fig. 4 the palisade-tissue is much reduced, whereas in Fig. 3 it is well developed near the ventral as well as near the dorsal surface. The same reduction ·is observed in the spongy parenchyma, and, what is most important, the mangrove growing in the salt mud has developed more and greater vascular bundles. As the ramifications of the vascular bundles are prolonged, the bundles themselves become smaller and smaller and, finally, are of very simple structure. When the vessels disappear, there remain only spirally and reticulately thickened tracheids, which prove to be excellent channels for the conduction of water. (Fig. 5, Plate B, shows the termination of vascular bundles with tracheids.)

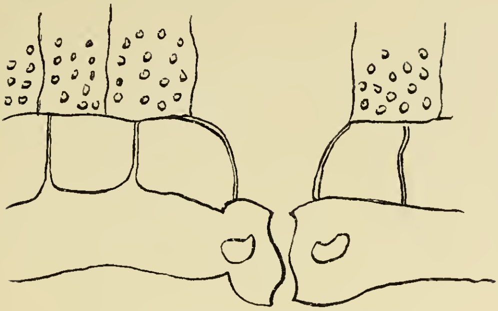


FIG. 1. Epidermis with stoma of Rhizophora mucronata.

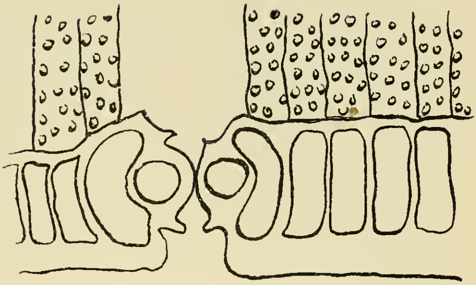


FIG. 2. Epidermis with stoma of Sonneratia acida.

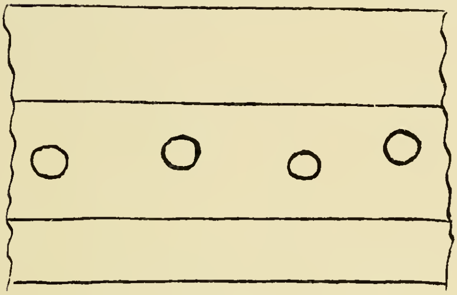


FIG. 3. Sonneratia acida on salt ground.

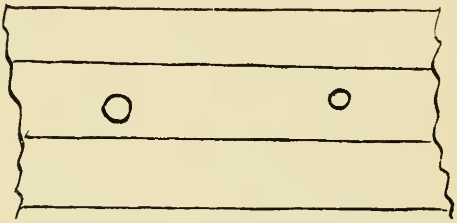


FIG. 4 Sonneratia acida on common ground:

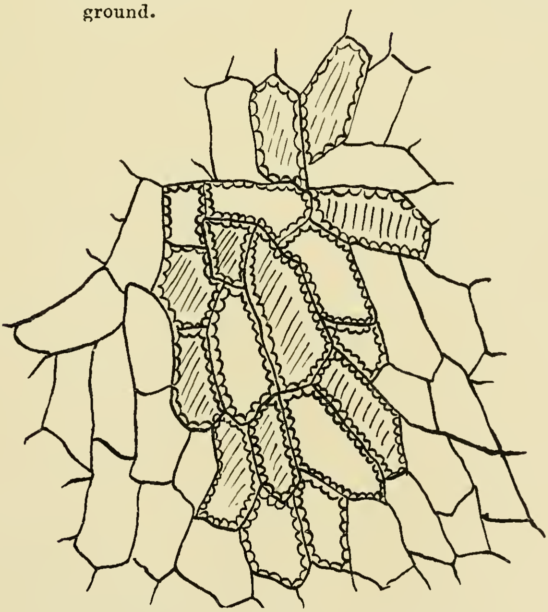


FIG. 5. Tracheids of Sonneratia acida.

A. P CORTEZ & CO.

Especially well developed is the aqueous tissue in the old yellow leaves of *Rhizophora mucronata*. The fact that these leaves are much thicker and more fleshy than the green leaves of the same plant, is due to the circumstance that those leaves which have become unfit for further assimilation develop a large aqueous tissue, which serves for some time as a water-reservoir.

What we have observed in a few representatives of the mangrove vegetation is equally applicable in some way or another to the rest. If we consider all those structural peculiarities, we find that they belong to the xerophilous type, *i.e.*, they all are adaptations which help to diminish the transpiration of the plant. Just for this reason the mangrove is characterized by the extraordinarily thickened and cuticularised walls of their epidermal cells, because these diminish the transpiration from the outer surface of the leaves. In the same direction works the circumstance that the intercellular spaces in the mesophyll are reduced. It is a striking fact that the intercellular spaces are always larger where there is abundance of moisture than in places where there is only little of it as, *e.g.*, in deserts, on a rocky ground, on sand or gravel. Plants growing on these substrata show in the same way the other peculiarities of the mangrove, *viz.*, lengthening of the palisades, depression of the stomata, formation of aqueous tissue and multiplication of the vascular bundles. This latter contrivance renders the regular conduction of water to all parts of the tissue easier and is, at the same time, a means for the removal of the prepared food-materials. One would not think at first sight that the mangrove needed the structural modifications which are so useful and even necessary for the existence of those plants which grow in dry places. The mangrove sends its roots deep down into the mud, its stems are washed by the water for many hours of the day, and the branches and leaves are surrounded by a moist atmosphere and, nevertheless, it exhibits all the anatomical peculiarities charaterizing those plants which are forced by circumstances to be economical in the expenditure of their water. It is a general experience that salts in solution render the osmotic absorption of water by the roots difficult. These receive much more water if it is in a chemically pure state than from solutions, and there is fixed for every plant a certain degree of concentration, usually not exceeding 3 per cent. beyond which absorption of water by the root does not take place any more. It is for this reason that a substratum fermented by a rich salt solution is, with respect to the living organism, physiologically dry. In consequence of that physical action exercised by the salts in solution, a too great concentration of salts in the assimilatory tissue would show its noxious chemical influence upon the metabolic processes, if not at the same time, there were a sufficient number of contrivances preventing too profuse a transpiration. It is especially the aqueous tissue which counterbalances the concentration of salts in the assimilating cells. As the absolute amount of salt increases in the course of time, we can easily understand that it is just the old leaf which develops a rich aqueous tissue, keeping pace in its development with the accumulation of salts in the cells of the same leaf.

BIRDS NESTING IN THE MURREE HILLS AND GULLIES.

By Lt.-Colonel R. H. Rattray.

Part II.

(With Plates C, D and E.)

(*Continued from page 428 of this Vol.*)

673. Merula castanea.—The Grey-headed Ouzel.

Common round Murree, but one of the commonest birds round Changla and Dungagalis. Nests were in varied situations. I found them in banks, holes in rocks, among roots of dead fallen trees, and in a hole in tree trunk up to 10 or 12 feet from ground. Birds very tame; did not leave nest until I came within 3 or 4 yards of tree or nest. The two photographs shew typical nest in bank and one in roots of old dead tree.

676. Merula boulboul.—The Grey-winged Ouzel.

Very common everywhere; found nests almost daily.

678. Merula unicolor.—Tickell's Ouzel.

Common, but not nearly so much so as the last two species both near Murree and the Galis. Numerous nests and eggs.

690. Petrophila erythrogastra.—The Chestnut-bellied Rock-Thrush.

Birds fairly common, but nests very hard to find. I used to see and watch one pair daily, but failed to find nest. I found one near Murree with 4 well-grown young ones. Nests often in very nasty places on side of steep khuds.

691. Petrophila cinclorhyncha.—The Blue-headed Rock-Thrush.

Common near Murree, less so higher up. Numerous nests and eggs, and on two occasions eggs of the Common Cuckoo in nests.

693. Petrophila cyanus.—The Western Blue Rock-Thrush.

Rare. I only saw birds near Murree, and during two seasons there only obtained 2 nests, both in holes in rocks.

698. Oreocincla dauma. The Small-billed Mountain-Thrush.

Only found on the higher hills round Changla and Dungagalis; the bird though common is very shy and retiring, and has to be looked for. I found 3 or 4 nests during June.

741. Pycnorhamphus icteroides.—The Black and Yellow Grosbeak.

Common. It breeds freely, and several nests were found at Murree, Dunga and Changlagali. Nests difficult to find and were generally placed high up in a dense fir tree. In my opinion many birds lay twice, at Murree, and again at Dungagali. This year I found nests at end of May, and again, in July when numerous young birds were about eggs were found. I think that as soon as the young are able to shift for themselves a second nest is at once made.

745. PYRRHULA AURANTIACA.—The Orange Bullfinch.

A few of these birds are to be found on top of Miranjani where they breed. I, however, failed to find nests. On one occasion in the beginning of July I saw a pair with 4 young ones just able to fly from tree to tree on top of a hill near Dungagali about 9,000 ft. I am, therefore, certain of a few nests there.

767. CARDUELIS CANICEPS.—The Himalayan Goldfinch.

Rare. I obtained one nest below Dungagali with 4 fresh eggs on 10th June 1904. Elevation about 5,000 ft. These were the only birds seen, but are said to be common by my collectors. Can it be possible that these birds have two broods in the year—one about 5,000 ft. early in June and a second in Kashmir high up in August. Major Buchanan found numerous nests in Kashmir during August ?

772. HYPACANTHIS SPINOIDES.—The Himalayan Greenfinch.

Fairly common at Murree and the Galis. I took four nests at Murree and one at Dungagali this year with eggs, but found many more that were destroyed by the heavy rain and deserted. These birds arrive suddenly at Murree about the middle of June, and at once set about building. 3rd July was the earliest date on which I got eggs. Nests generally high up on fir trees, neatly made. Eggs as described, but generally of a beautiful shape, delicate ovals and very fragile.

780. PASSER CINNAMOMEUS.—The Cinnamon Tree-Sparrow.

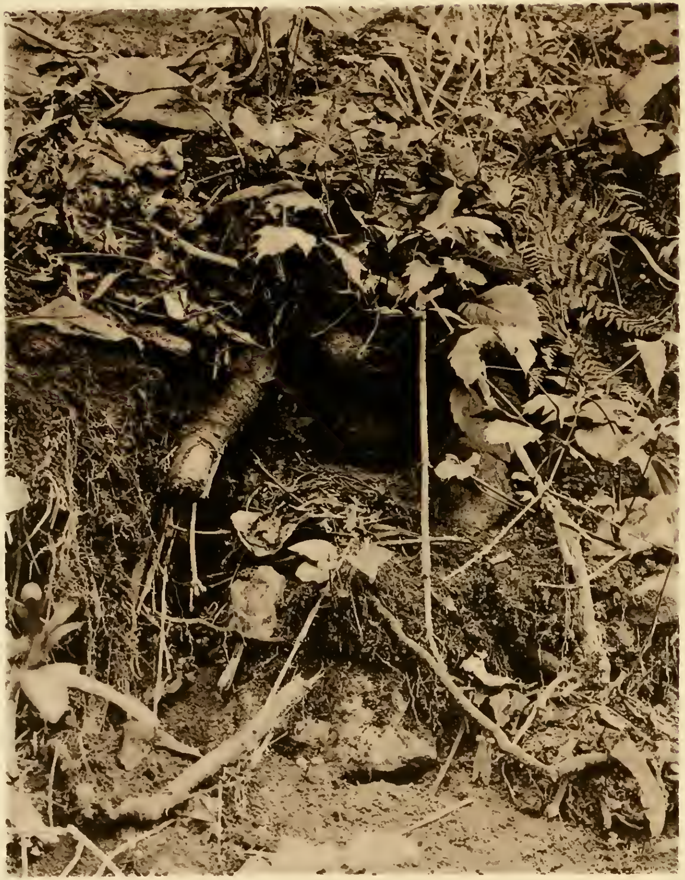
Common at Murree, less so round Changla and Dungagalis. Obtained numerous nests at all three places.

793. EMBERIZA STEWARTI.—The White-capped Bunting.

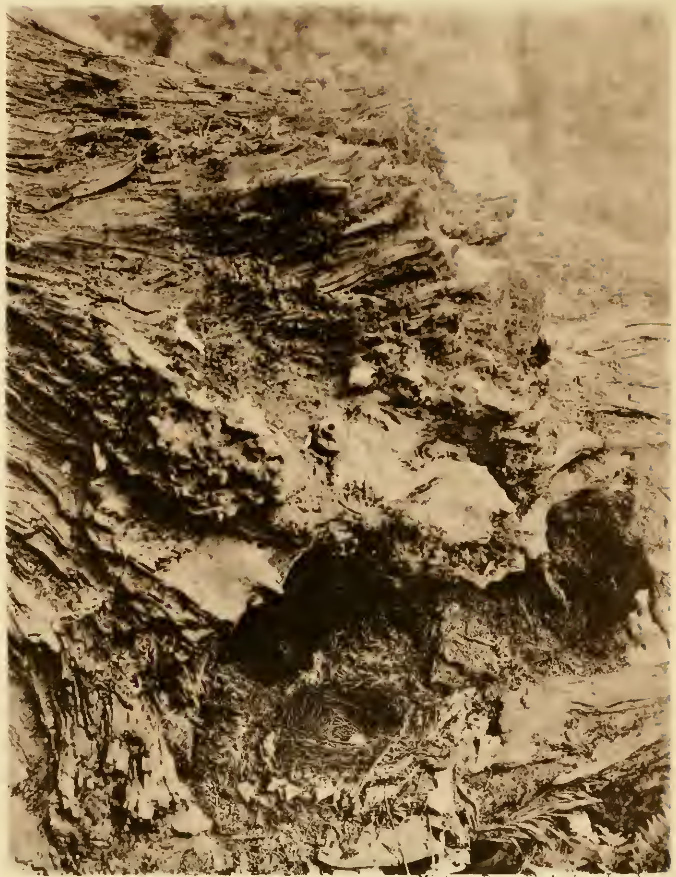
Common. I obtained numerous eggs from Murree and the Gullis. They breed from about 5,500 ft. up to 7,500 ft.

794. EMBERIZA STRACHEYI.—The Eastern Meadow-Bunting.

One of the commonest birds round Murree, where I took numerous nests ; it is also common round Changla and Dungagalis. The eggs are



NEST OF THE "GREY-HEADED OUZEL" IN A BANK.
(Merula castanea.)



Mintern Bros. Photo-imp. London.

NEST OF THE SAME
UNDER THE END OF A FALLEN TREE.

exactly like those of our English Yellow Hammer, but rather more greenish in tinge.

805. CHELIDON KASHMIRIENSIS.—The Kashmir Martin.

Common in the Galis, not found at Murree. These birds were breeding in great numbers under the verandah in the dâk bungalow at Changla and Dungagalis ; the nests are in most cases exactly like our English Martin, but the bird out here more often takes advantage of a beam on which to rest its nest ; it is also a more familiar bird.

810. PTYONOPROGNE RUPESTRIS.—The Crag-Martin.

A few pairs of birds bred under some overhanging rocks—the place was most difficult to get at, and only one or two nests were within reach. Around Dungagali the birds were breeding in June, but at Bhaganota, which is considerably lower, all eggs were hatched and in many cases the young able to fly by the 6th June. The eggs are marked more with a dark sepia than red.

822. HIRUNDO NEPALENSIS.—Hodgson's Striated Swallow.

Common at Dungagali and Changla. I did not see birds at Murree. I caught number of birds on nests for purpose of identification. Most of the nests were in verandahs ; the birds were most tame and it was most interesting watching them collecting mud for their nests.

853. OREOCORYS SYLVANUS.—The Upland Pipet.

The birds were common enough round Murree and the Galis, but I found very few nests. In one I found an egg of *Cuculus canorus,* our common Cuckoo. This egg was absolutely fresh, while the eggs of foster parent were on the point of hatching out. It would be interesting to know what would have happened in this case.

946. GECINUS SQUAMATUS.—The West-Himalayan Scaly-bellied Green Woodpecker.

A common bird everywhere in the hills. I found numerous nests with eggs and young.

950. GECINUS OCCIPITALIS.—The Black-naped Green Woodpecker.

Not nearly so common as the last, but still common. I have no doubt, in many cases where there were young birds in the nests I did not carefully identify the birds.

960. HYPOPICUS HYPERYTHRUS.—The Rufous-bellied Pied Woodpecker.

A rare bird at Murree, but fairly common at Dungagali. Nests very difficult to find, as it selects a much more enclosed and dense portion of the forests for its nest. I took one nest at Murree and two near Dunga.

961. DENDROCOPUS HIMALAYENSIS.—The Western Himalayan Pied Woodpecker.

This is the commonest of the Woodpeckers. I took numerous nests at both places, but most had young in nests—nests at all heights from the ground from about 10 to 60 feet.

967. DENDROCOPUS MACII.—The fulvous-breasted Pied Woodpecker.

Common at Murree, but I failed to find a nest. I did not see a single bird in the Galis.

969. DENDROCOPUS AURICEPS.—The Brown-fronted Pied Woodpecker.

Common at Murree, but not in the Galis; it does not appear to breed above 7,500 feet. I took one nest with eggs at Murree and some others with young birds.

1006. MEGALÆMA MARSHALLORUM.—The Great Himalayan Barbet.

Very common at all three places. Its loud plaintive cry, as Jerdon calls it, is so much in evidence as to be a nuisance. I took eggs at Murree and near Dungagali.

1066. UPUPA EPOPS.—The European Hoopoe.

Common at Murree and breeds. I saw very few birds higher up round the Galis. Took numerous nests.

1068. CYPSELUS MELBA.—The Alpine Swift.

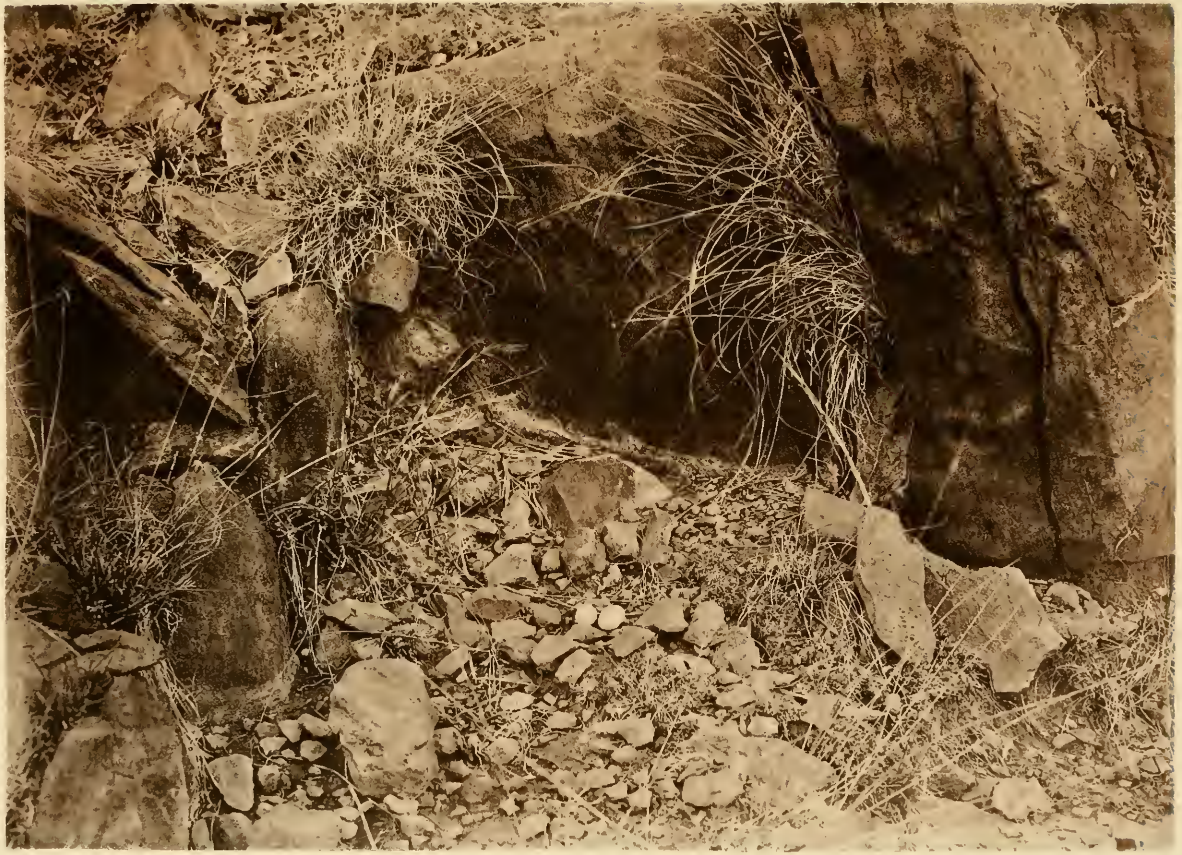
I used to see the birds often flying round Dungagali, but only late in the season found two nests both with young ones. These nests were not as described, but far inside a crack in solid rock on face of a precipice. I could not get my arms in, but caught one young bird as it flew out, so cannot say what the nest was made of.

1095. CAPRIMULGUS INDICUS.—The Jungle Nightjar.

I found one nest near Dungagali on a bare hill side on 7th June 1904, with 2 very hard-set eggs. The eggs were, as usual, laid on the ground exposed to the sun all day. The photo is of a nest and eggs at Fort Munro, Baluchistan, on 28th July 1904, and exactly like the others.

1092. CAPRIMULGUS EUROPÆUS.—The European Nightjar.

I only found these birds near Dungagali. I took two nests—one just inside the forest belt and the other on a bare hill side. They are not common. Eggs exactly similar to some I took some years ago.



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EGGS OF THE JUNGLE NIGHTJAR.
(Caprimulgus indicus.)

1104. Cuculus canorus.—The Cuckoo very common. I took a number of eggs at Murree and three near Dungagali. The eggs are laid in a large number of nests.

1105. Cuculus saturatus.—The Himalayan Cuckoo.

Common. I took 3 eggs from oviduct of female at Murree and some other eggs at Murree and two eggs near Dungagali. All were from nests of *Acanthopneuste occipitalis.* (The Large-crowned Willow Warbler.)

1106. Cuculus poliocephalus.—The Small Cuckoo.

Birds fairly common but not often come across unless searched for. I took an egg at Murree and one at Dungagali I am not entering into any discussion as to colouring of eggs, as this has been done in an admirable paper by Mr. E. C. Stuart-Baker, which will appear about the same time as this. This remark also applies to next species. I took both my eggs from nest of Large-crowned Willow Warbler.

1107. Cuculus micropterus.—The Indian Cuckoo.

I took numerous eggs I attribute to this bird at Murree and one at Dungagali this year. Two of the eggs were in nests of *Trochalopterum lineatum* and the remainder in *Larviyora brunnea,* the Indian Blue Chat. I am certain the eggs are blue in some cases (about 1 in 3 eggs), with a few darker blue or lilac spots.

1108. Hierococcyx sparverioides.—The Large Hawk Cuckoo.

Rare at Murree but fairly common round Dungagali. I took one egg from nest of *Trochalopterum simile,* it is exactly like one I took some years ago from oviduct of female. The egg is blue. Mr. Stuart-Baker has again given the fullest information about this bird in his paper.

1112. Cacomantis passerinus.—The Indian Plaintive Cuckoo.

A rare bird. I only occasionally heard and saw it near Murree. I took one egg there.

1117. Surniculus lugubris.—The Drongo Cuckoo.

A very rare bird. I shot one bird in Murree about 5,500 feet elevation in 1899, and took an egg that must, I think, belong to this bird near the same place as the bird was shot ; it was in nest of the Ashy Drongo ; this egg was quite fresh while Drongo's eggs were hard set.

1141. Palæornis schisticeps.—The Slaty-headed Paroquet.

Very common. I saw numerous nest holes at Murree and Dungagali but all contained young ones.

1175. Scops spilocephalus.—The Spotted Himalayan Scops Owl.

Rare. I have only come across this bird once here; this year obtained a nest with eggs shooting hen bird. This was near Changlagali.

1186. Glaucidium brodiei.—The Collared Pigmy Owlet.

Birds common at Murree and more so at Dungagali, but I have only once this year obtained the eggs here. They hide their nest holes most carefully. This nest had 5 eggs. I have never previously taken more than 4 eggs.

No. 1198. Neophron percnopterus.—The Egyptian Vulture.

Birds common, but I have only seen one nest. This was taken on 11th May 1904 and contained 1 egg, a beautiful dark-coloured one. The nest was on a ledge of rock in an almost inaccessible precipice. The birds continued to occupy the nest, but did not lay again.

1206. Aquila hastata.—The Small Indian Spotted Eagle.

I was lucky enough to find one nest of this bird about 3 miles from Dungagali. The nest was placed high up in a tree growing on the face of a nasty precipice. Men only climbed up with the assistance of ropes. The nest contained 1 incubated egg and was taken on 7th June 1904. I shot the hen bird off the nest.

1210. Ictinaëtus malayensis.—The Black Eagle.

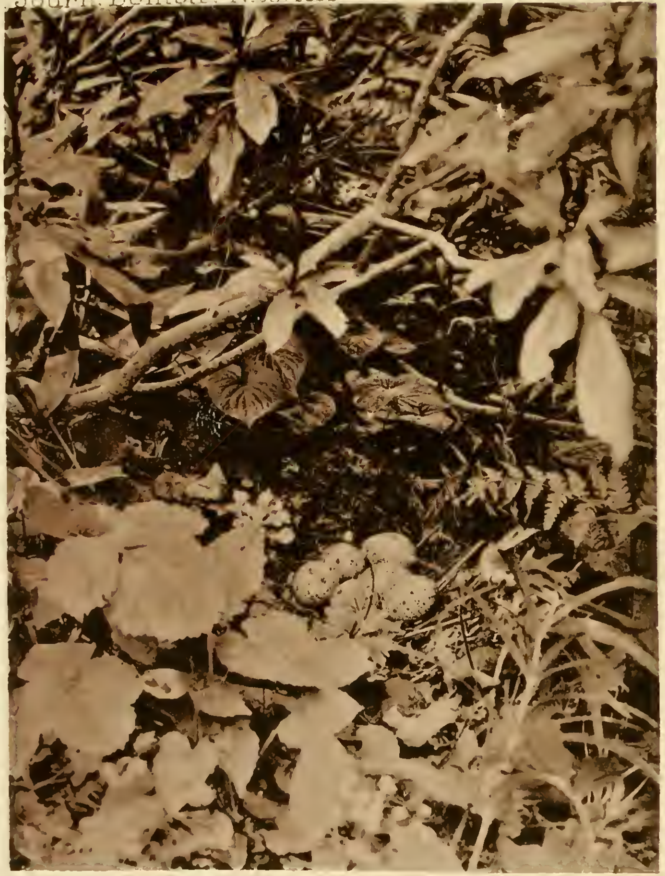
A nest with one much incubated egg near Changlagali on 4th May 1904. The nest was one of the nastiest to get at I have ever seen. It was high up on a fir tree on the face of a very bad precipice. The bird sat until the man was quite near the nest and then swooped down at him till shot at. The pair continued near the nest the rest of the season, but did not lay again. The egg is a very handsome one, smeared with grey and dark purple ; the markings are nowhere in blotches, but smeared, running round axis of egg. I do not think they lay more than one egg.

1217. Spilornis cheela.—The Crested Serpent-Eagle.

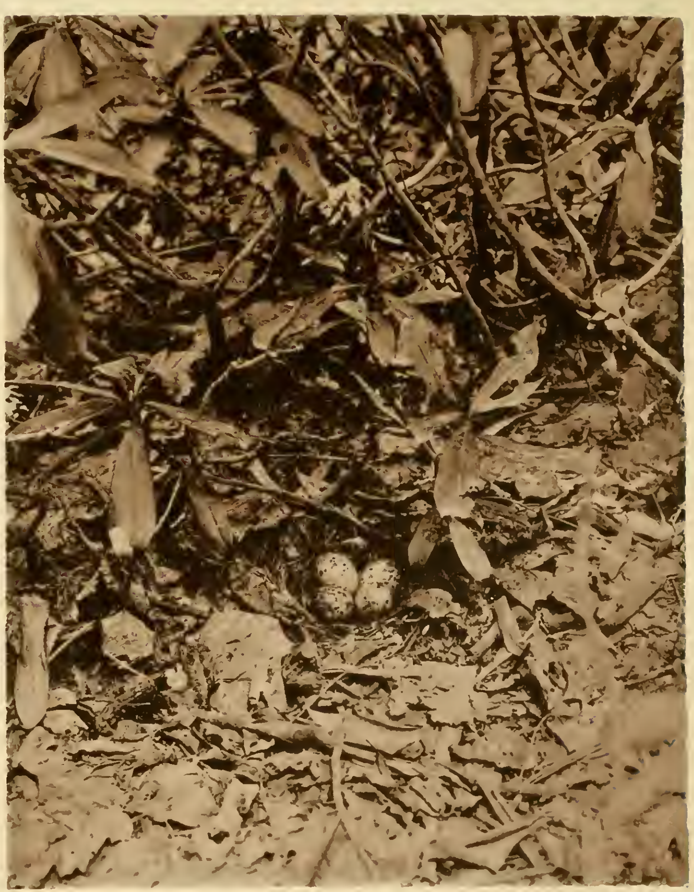
I obtained one nest with the hen bird on 6th May 1904 ; it was so much incubated it unfortunately broke in cleaning. The nest was high up in a fir tree. The single egg was a long narrow oval much pointed at small end. Ground colour greyish-white with a dull dingy cap of pale brown ; it was without exception the dingiest eagle or allied egg I have ever seen.

1229. Milvus govinda.—The Common Pariah Kite.

Common. I saw several nests at Murree and Dungagali, but did not trouble to take them down.



NEST OF THE "KOKLAS" OR PUKRAS-PHEASANT.
(Pucrasia macrolopha.)



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NEST OF THE WOODCOCK.
(Scolopax rusticula.)

1230. Milvus melanotis.—The Large Indian Kite.

I saw very few birds at Murree, none at Changla or Dungagalis. I obtained one nest at Murree in 1899; it was high up in a tall fir tree and contained three eggs.

1260. Falco subbuteo.—The Hobby.

A rare bird only found near top of Miranjani. I saw one nest building, but when visited about 14 days later was found deserted. Major Buchanan obtained eggs there some years ago.

1265. Tinnunculus alaudarius.—The Kestrel.

Common. I obtained a nest at Murree with 4 fresh eggs, and one this year at Dungagali with 5 eggs. I saw other pairs, but failed to locate nests, as they were in almost impossible places.

1283. Sphenocercus sphenurus.—The Kokla Green Pigeon.

Common. Numerous eggs at Murree and Dungagali.

1305. Turtur ferrago.—The Indian Turtle Dove.

Common everywhere. I saw and obtained numerous eggs at Murree and Dungagali.

1334. Pucrasia macrolopha.—The Koklas or Pukras Pheasant.

Common at Dunga and Changla Galis, none at Murree. I saw several nests with 5 to 7 eggs. The photo was taken of one about 8,000 feet elevation and is similar to all the others.

1336. Gennæus albicristatus.—The White-crested Kalij Pheasant.

I do not think this bird is common. I found one nest at Murree about 6,000 feet after the young had hatched out. I did not see the bird in the Galis.

1370. Caccabis chucar.—The Chukor.

There are a good number of birds round Dungagali and I think Murree, but I did not see birds there. I saw one nest near Dunga, but did not count the eggs for fear of disturbing the birds; there looked about 10 of them. I have found 15 in one nest.

1482. Scolopax rusticula.—The Woodcock.

This bird breeds freely round Changlagali from about 8,500 feet upwards. I saw some 8 or 10 pairs, and found some 5 nests each containing the usual 4 eggs. The nests were all in thick forest and generally under a shrub like Rue. The nest is a very typical one. I hope next year to get a good photo of a sitting bird and settle the question I lately ventilated in "The Field" as to birds sitting with eyes closed and bill resting on the ground.

INSECT LIFE IN INDIA AND HOW TO STUDY IT,

BEING

A SIMPLE ACCOUNT OF THE MORE IMPORTANT FAMILIES OF INSECTS
WITH EXAMPLES OF THE DAMAGE THEY DO TO CROPS,
TEA, COFFEE AND INDIGO CONCERNS, FRUIT
AND FOREST TREES IN INDIA,

BY

E. P. STEBBING, F.L.S., F.Z.S., F.E.S.

Part IV.

(*Continued from page* 131 *of this Volume.*)

Chapter VI.

Hymenoptera Petiolata—*continued.*

Series 2.—*Tubulifera.*

The trochanters are undivided and the hind body consists of from 3-5 visible segments; the female has an ovipositor which is usually retractile and contains a fine pointed lance. The larvæ usually live in the cells of other hymenoptera.

Compared with the *Parasitica* and *Terebrantia* this is a small group of Insects practically devoid of economic interest. One family is recognised.

Fam. IX. Chrysididæ—Ruby-Wasps.

The Ruby-Wasps are usually easily recognisable owing to their brilliant metallic colouring and to the curious construction of the abdomen, which allows the Insect to curl it completely under the front parts so as to roll itself up into a ball. The Insects have a very hard, coarsely-sculptured integument and elbowed antennæ of usually thirteen joints. The larva has the ordinary number of joints to its body found in the grubs of this order and thus does not differ as do the adults. The reason for the fewer number of visible segments in the bodies of the Ruby-Wasp is due to the fact that a greater number of the terminal segments are drawn into the body to make the telescope-like structure containing the pointed lance or style. Although the latter is occasionally used as a sting it is incapable of inflicting a serious wound.

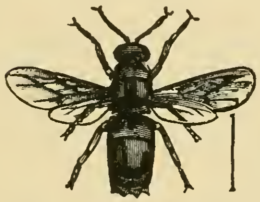

Fig. 54.—*Chrysis fuscipennis* (India and Burma.)

The Ruby flies do not attain a large size but owing to their brilliant colouration they are often to be noticed in India in verandahs and houses, flitting about and never stationary. Like other brilliant metallic coloured Insects they love the hot sunshine. In India there are numerous species amongst which may be mentioned *Chrysis fuscipennis* (Fig. 54), a metallic green Cuckoo-Wasp with a blue sheen which is found all over India and Burma up to elevations of 10,000 ft. This Insect is parasitic on three species of *Eumenes*, laying its eggs in the cells of these latter Insects (*vide p. infra*). Another species of Cuckoo-Wasp, *Chrysis oculata*, also found all over India and Burma, is metallic blue in colour with a copper-red spot on each side of the 2nd abdominal segment. It is shown in Fig. 55.

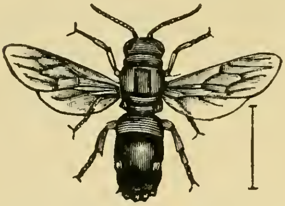

FIG. 55.—*Chrysis oculata* (India and Burma).

SERIES 3.—*Aculeata.*

The trochanters of the legs consist of one piece and the abdomen has six or seven visible segments; the female is provided with a retractile sting. Antennæ usually 13-jointed in male, 12-jointed in female. There are however numerous exceptions to this amongst the ants.

The larvæ are legless grubs of soft consistence and live either in cells or, in the case of the social forms, in the abodes of the parents. The larvæ of the ants and *Fossorial Aculeata* have the anterior parts of the body long and narrow and abruptly bent so that their heads hang down. The pupa is always soft and gradually assumes the colour and hardness of the perfect Insect.

Fam. X. Apidæ—Bees.

The bees are usually very hairy Insects provided with elbowed antennæ; the hairs may be simple, spiral or plumose, the parts of the mouth are elongated so as to form a protrusible tubular proboscis, which is sometimes of considerable length. The hind body is never narrowed at the base into an elongate stalk as is the case in wasps and Fossores (cf. Fig. 56 and Fig. 67). The basal joint of the hind foot is elongate, the tibia and tarsi of this leg being usually broad.

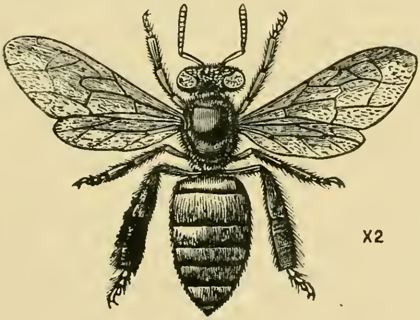

FIG. 56.—*Apis dorsata.* The Big Indian Bee (India).

There are no wingless adult forms amongst the bees; in the species which live in societies or colonies barren females, called workers, exist and carry on the work of the community.

The food of bees is always obtained from the vegetable kingdom or from other bees. It usually consists of pollen worked up in various ways. In this connection the hind legs of bees are of considerable importance and Sharp* makes the following interesting remarks on this subject: "The hind legs of bees are very largely used in the industrial occupations of these indefatigable creatures; one of their chief functions in the female being to act as receptacles for carrying pollen to the nest: they exhibit, however, considerable diversity. The parts most modified are the tibia and the first joint of the hind-foot. Pollen is carried by other parts of the body in many bees, and even the hind leg itself is used in different ways for the purpose: sometimes the outer face of the tibia is highly polished and its margins surrounded by hair, in which case pollen plates are said to exist; sometimes the first joint of the tarsus is analogous to the tibia both in structure and function; in other cases the hind legs are thick and densely covered with hair that retains the pollen between the separate hairs. In this case the pollen is carried home in a dry state, while in the species with pollen plates, the pollen is made into a mass of a clay-like consistence. The legs also assist in arranging the pollen on the other parts of the body. The males do not carry pollen, and though their hind legs are also highly modified, yet the modifications do not agree with those of the female, and their functions are in all probability sexual."

As is well-known bees frequent flowers, but not, as usually stated, to gather the honey. They really extract the nectar which is said to be almost pure saccharose; this they swallow and, according to one authority, it is regurgitated as dextrose and levulose. Probably all bees also eat pollen while collecting it. The pollen collected mixed with honey serves as the food for the colony.

The young of bees are always reared in cells and these cells (except in the case of the parasitic bees) are built by the mothers or workers. The solitary bees store the cells with food and close up each cell after having laid an egg in it, so that in these cases each grub feeds upon a store of food previously provided for it. The social or colonial bees (those living in hives, open combs, &c.) do not close the cells in which the larvæ are placed, but are fed by the workers very much in the same way that nestling birds are fed by the parents. The food is honey and pollen mixed in proportions which vary for different species ; the honey seems to be specially suitable to the young larvæ as those bees which make closed cells place on the top of the mass of food a layer consisting principally of honey which layer is first consumed by the young grub. The larva reaches its full size in a very short space of time but rests for a more or less prolonged period before transforming into the pupal stage. The pupa shows the antennæ, wings, legs, &c., of the perfect insect very distinctly, the development of the latter being quick. Some larvæ spin cocoons, others do not.

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* Cambridge Natural History, Vol. VI., 12.

There are a large number of parasitic bees, *i.e.*, bees which lay their eggs, either one or more, in the cell of a working bee of a different species. The larvæ developing from these eggs grow more rapidly than those of the host and so cause the latter to die of starvation.* In some cases the parasitic larva ends by consuming the grub it has robbed before pupating.

The classification or grouping of the bees is in an unsatisfactory state. It will be sufficient for our purpose here to consider the following groups:— The Parasitic bees (Denudatæ), Carpenter bees (Scopulipedes), Mason and Leaf-cutting bees (Dasygastres) and the Social or Colonial bees (Sociales).

The Parasitic Bees (DENUDATÆ) are long-tongued solitary bees with no pollen-carrying apparatus. They lay their eggs in the cells of other bees and often have a great resemblance to their hosts. Amongst those known in India are *Stelis parvula* and *S. cornuta*, the latter being shown in Fig. 57. Nothing is known of their habits.

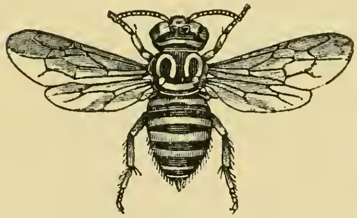
FIG. 57.—*Stelis cornuta*—A Parasitic Bee (Rangoon).

The SCOPULIPEDES include the Carpenter bees (Xylocopa), long-tongued solitary bees which are not parasitic. The genus Xylocopa contains many of the largest and most powerful of the bees and is well represented in India. They are usually black or blue-black in colour (some species in India have a brilliant canary-yellow thorax, whilst others have bright yellow and red abdomens), of broad robust build, with shining integuments more or less covered with hair. They are known as carpenter bees from the habit of some of them of boring into dry timber. They will not touch living wood nor will they tunnel into rotten wood. Sound seasoned timber appears to be what they prefer. They bore a cylindrical tunnel into the wood from which 3 or 4 parallel galleries give off in which broad cells are placed. These cells are always isolated by a partition formed by cemented fragments of wood which are cut out by the bee. Little is known about the life histories of our Indian species nor do we know how many generations they pass through during the year. *Xylocopa latipes* depicted in Fig. 58 is a large blue and green *Xylocopa*, widely distributed throughout India and ranging down into China and the Malayan Region. It tunnels into sal wood in the Bengal Duars occasionally causing serious damage to the rafters of the tea factories and other buildings, whilst others have been found boring into Padouk in Calcutta (imported from Rangoon) and teak in Rangoon.

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* Bertrand, Bull. Mus. Paris, i. 1895, p. 38.

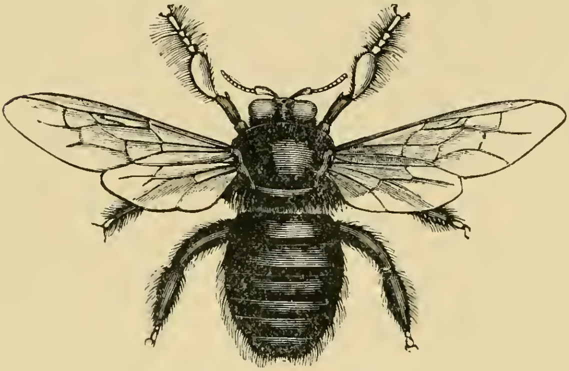

FIG. 58.—*Xylocopa latipes.* (India.)

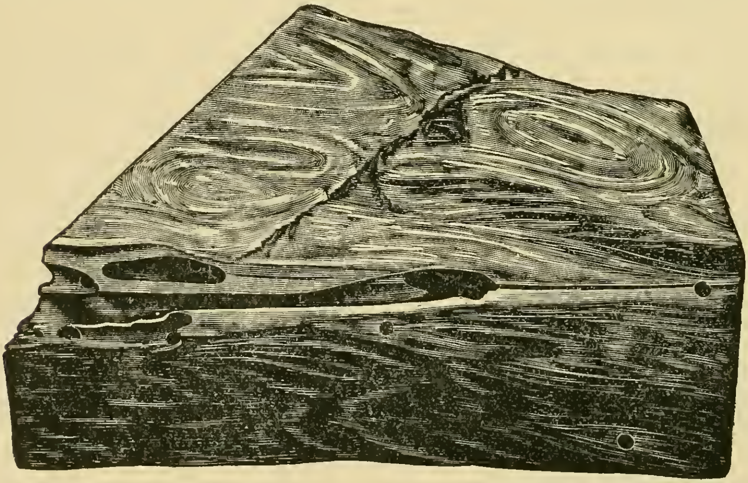

FIG. 59.—Block of Padouk wood showing borings of *X. latipes.*

Xylocopa chloroptera is the common carpenter bee of East India, Burma, Moulmein, &c., which selects hollow bamboos for its cells ; it connects together the pieces cut out of the interior partitions of the bamboo, using them as horizontal partitions inside the bamboo to separate the internal cavity into cells. This species is much infested with a small Chalcid parasite (*Encyrtus*), of which as many as 300 specimens of the fly have been bred from a single larva of the bee.

The group DASYGASTRES includes the mason and leaf-cutting bees in which the ventral surface of the hind body is densely set in the females with regularly arranged hairs by which the pollen is carried. In many, as in Megachile, the labium is very large and in repose is deflected on to the lower side of the head. This group includes some of the most interesting and perhaps to the general public some of the best known of the solitary bees. The mason and leaf-cutting bees are well-known in India.

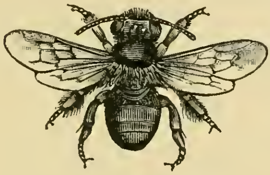

FIG. 60.—*Megachile anthracina.* The leaf-cutting bee. (United Provinces.)

The leaf-cutting bees cut long or circular portions out of green leaves to form the partitions of their cells. A well-known Indian one is *Megachile anthracina (fasciculatis)* depicted in Fig. 60. It cuts long pieces out of rose or pulse leaves and forms its cells of these, a circular piece being cut to serve as the lid. These cells resemble an ordinary-sized thimble. Horne states that in one specimen examined by him thirty-two pieces of leaf disposed in seven layers were used for one cell, in addition to three circular pieces for the lid. Some kind of gummy material is believed to be used to keep in place the pieces forming the interior layer. This is not however invariably the case as in a species found by the writer in a tunnel in blue pine wood in the

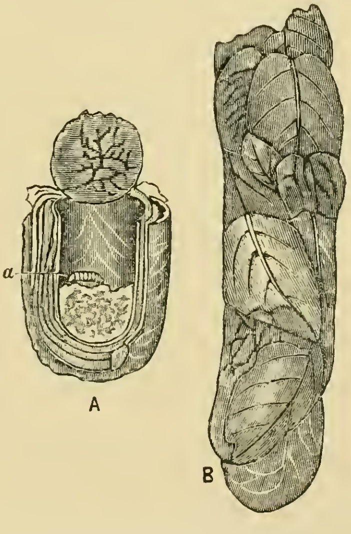

FIG. 61.—Nest of the leaf-cutting bee, *M. anthracina.* A, a section of a separated cell with lid raised; larvæ (*a*) nesting on the food. B, portion of a row of cells. (After Horne).

Himalayas, the leaf pieces used were merely tightly wedged in their places. The cells are placed end to end as shown in Fig. 61 B, five to seven cells forming a series and four to six series are believed to be constructed by one pair of this bee, the mass being placed in a hollow in masonry or similar position. Each cell when completed is half filled with pollen and an egg laid in it. This bee is much infested by parasites and is also eaten by the Grey Hornbill (*Meniceros bicornis*). A Lower Burman species makes its nest in the young shoots of teak saplings, entering by a hole at one side. One generation of the fly issues towards the end of January.

Megachile lanata, shown in Fig. 62, is the common bee found in Indian houses and especially verandahs. Horne states that both sexes take part in constructing the cells. These cells are formed of clay and a hollow cavity of almost any kind will be made use of; the back of a book, an empty punkha-rope hole in the wall, the barrel of a rifle or gun, &c., are often found tenanted by the cells of this insect.

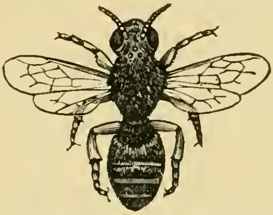

FIG. 62.—*Megachile lanata.* The mason-bee. (United Provinces.)

The Social Bees (SOCIALES) include the genera Bombus, Melipona (Trigona) and Apis.

Bombus or the bumble bees are more like wasps in their habits than bees in that the societies die off at the end of the season, only a few females living through the winter, each of which starts a new colony the following spring. *Bombus orientalis* is a large black, yellow and red bumble bee, very common about Darjiling. It is shown in Fig. 63. Males, females and workers are present in the nests. These latter are found in the ground amongst moss, leaves, &c.

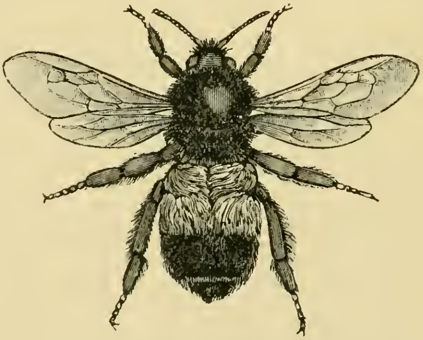

FIG. 63.—*Bombus orientalis.* A common Darjiling bee. (Darjiling.)

Melipona includes several species of very small bees which are common in India, but little is known about their life histories. They are sting-

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Horne. Trans. Zool. Soc., Lond., vii., 1870, p. 178.

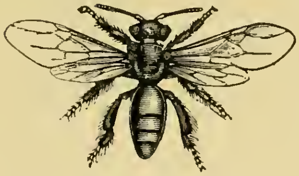

FIG. 64.—*Melipona (Trigona) thoracica.* (Tenasserim.)

less bees which build their nests in old walls, &c., the nest being formed chiefly of chewed resin. They produce honey and wax in considerable quantities, but no attempt has ever been made to domesticate them. *Melipona* (*Trigona*) *thoracica* is common in Tennasserim. It is shown in Fig. 64. *M. indipennis*, another species, has been taken at Barrackpore near Calcutta and is also common in Burma.

The genus Apis contains the wild honey bees *par excellence* of India. In these bees we get the three forms of male, female and worker. The males are the drones and do no work. Neither the male nor female take any part in the provision of food either for themselves or the young. The colonies are permanent, *i.e.*, they do not end at the close of a season, the formation of a new colony taking place by what is termed 'swarming.' This swarming of bees is not a nuptial flight as is usually supposed. The swarm consists of one female and a number of workers. These workers build the new comb. The comb consists of a number of hexagonal cells, consisting of wax, in contact with one another at the sides. The queen lays an egg in each cell and as these hatch the young larvæ are fed by the workers. Some of the cells are used for storing honey in. The fertilisation of the young queen takes place during a solitary flight after the swarm has settled down. Three species are known: *Apis dorsata*, *A. indica* and *A. florea*. *A. dorsata* is the big bee shown in Fig. 56. It constructs large nests consisting of a single semi-elliptical comb of as much as five feet across and two feet deep, either suspended to the underside of the branches of lofty trees or to portions of buildings or attached to the rocks of precipitous cliffs as, for instance, at the Marble Rocks on the Narbada River near Jubbulpore and in the Ajanta Caves, Bombay. This bee can be recognised by its size and elongate body. Its sting is very poisonous, being almost deadly in the hot weather and almost certainly so to Europeans if inflicted in numbers when the blood is in bad condition. That this is invariably so in the case of the jungle tribes of the country is doubtful as the writer has seen Kols and Santals with many stings in their bodies, but apparently suffering no inconvenience therefrom. This bee is very difficult to dislodge as it will return again and again to a chosen site, thereby greatly disfiguring buildings. Arches in the Taj

Mahal at Agra were at one time greatly disfigured by the combs of this insect.

The following interesting note by Major T. R. A. G. Montgomery on the nuisance and damage committed by this bee at the Ajanta Caves appeared in the *Pioneer** some time ago:—

The Collector of Khandeish has written to warn visitors to Ajanta of the danger caused by bees. These industrious and vindictive insects appear to be as dangerous now as they were in 1877, when Mr. Burgess, the Archæologist, "was dreadfully stung and had to remain in the river for hours up to his chin in water." So important was the matter formerly considered that in the 1879 edition of *Murray's Handbook*, travellers to India are recommended to supply themselves, as part of their outfit, with "a pair of stout leather gauntlets coming up above the wrist half-way to the elbow, and a light wire-mask with a back-piece to protect the back of the head and neck," for use when visiting the caves of Ellora and Ajanta as a protection against the bees, "many persons having been so badly stung that in some cases death has ensued." In the same guide-book we read as follows:—"Having located himself, the traveller will do well to send for Imam, the great beehunter of Ajanta, and inquire in what state the bees are. If likely to be troublesome, Imam will arrange for their destruction before the caves are visited." Apart, however, from the danger to those visiting what *Murray* describes as "the most extraordinary sight that India has to show," there is another fact I would like to bring forward, namely, that the bees are one of the chief causes of damage to the famous wall paintings in the caves. In Messrs. Ferguson and Burgess's book on the Cave Temples of India it is stated that "forty years ago (*i.e.*, about 1839) the paintings at Ajanta were very tolerably complete and their colours exhibited a freshness which was wonderful, considering their exposure to the vicissitudes of an Indian climate for from 15 to 18 centuries. Since that time, however, bees, bats and barbarians have done a great deal to obliterate what was then so nearly perfect." As the State protection of the remains of ancient India is now about to pass into law, might I suggest to the authorities that a small portion of the money that will soon be annually allotted for the purposes of preservation be devoted to the eviction of the bees of Ajanta caves? This would simply mean a trifling amount spent in wages to Imam, the bee-hunter, if he is still alive and active or to his successors if he is dead. It is not every day or in every country that one can see paintings seventeen hundred years old, and it will be indeed a pity if the present opportunity be not taken for establishing the periodical ejection of the bees and bats of Ajanta, on the twofold grounds of preserving the paintings and ensuring the safety of sightseers; while as for the "barbarians" they will soon have become creatures of the past. Furthermore, any steps taken in the direction of facilitating the journey to Ajanta, and rendering a short sojourn there more convenient than at present, would invoke the heartfelt thanks of modern pilgrims to the desolate shrines of one of the grandest of religions.

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* Allahabad, *Pioneer*, January 19th, 1903.

A. dorsata appears to be common all over the country and goes up to over 7,000 feet in the Himalayas. When disturbed it will attack, with the utmost fierceness, both man and animals. There is a considerable trade in its honey and wax, but to obtain them the comb has to be destroyed and the natives are very careless in their method of collection, pressing the whole into great balls containing pieces of twig, dirt and other impurities. It is doubtful whether this bee can ever be domesticated. Could it be done there can be little doubt as to the great commercial value it would have.

Apis indica (see Fig. 65) is a smaller bee, whose habits are like the European *A. mellifica*, which builds in hollow trees, holes in walls, &c. Bingham† states that in Burma, where no species of honey-bee is domesticated by the Burman, he has more than once seen a house (the houses are chiefly built of wood) rendered nearly uninhabitable by a swarm of *A. indica* taking possession of the hollows under the wooden staircases, or of the space between the outer walls when these were built double.

The honey of *A. indica* is particularly sweet and attempts have been made to domesticate it in various parts of India including parts of Bombay, the Kuram Valley, most districts of the Himalayas, and Assam. In the latter province the matter has been taken up by the Agricultural Department. The method of rearing as practised in the Khasi Hills is crude and not unlike the old system of rearing bees in skips practised at Home. Attempts are to be made to introduce the bar-frame hive.

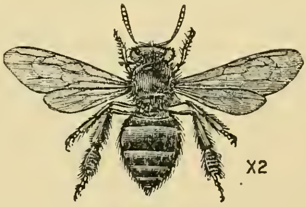

FIG. 65.—*Apis indica.* The Indian honey bee. (India.)

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† Bingham. Blanf. *Faun. Br. India.* Hymenoptera, Vol. I, 557.

A. florea (Fig. 66) is the smallest of the bees; it is about the size of a small house fly and builds its single comb on the branches of trees or in bushes or under the eaves of houses. Its honey is very sweet, but is in too small a quantity to be worth cultivation.

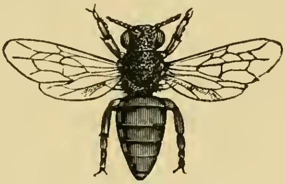

FIG. 66—*Apis florea.* The small Indian bee. (India.)

Fam. XI. Diploptera (Vespidæ)—Wasps.

The wasps can be easily distinguished by the fact that when at rest the upper wings are longitudinally plicate, that is, they are longitudinally folded down the middle. This is well shown in Sharp's drawing of *Eumenes flavopicta*, a Burman solitary wasp shown in Fig. 67. The trochanter is simple, the antennæ elbowed, the eyes reniform and the mandibles long and projecting.

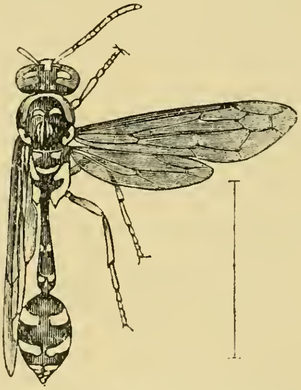

FIG. 67.—*Eumenes flavopicta* ♀ (Burma). The wings on the left in the position of repose, to show folding. (After Sharp).

The wasps are either solitary or social and some have the three forms, males, females and workers.

The Solitary Wasps (*Eumenidæ*) are more numerous than the social ones though perhaps less noticeable. They may be distinguished by having the claws of the foot bifid or toothed, the middle tibiæ having only one spur at the end. There are no workers.

A common Indian Solitary Wasp is *Eumenes conica* (Fig. 68) which constructs clay nests with very delicate walls. In these nests about a dozen green caterpillars are placed in a mass together, there being only one cell. It apparently usually selects light-green caterpillars for provisioning the nest with, although occasionally dark coloured ones may be found. An egg is laid in the nest and the larva on hatch-

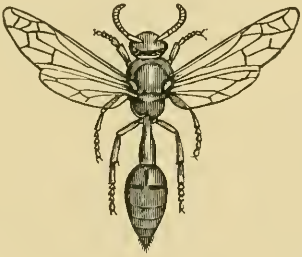

FIG. 68.—*Eumenes conica.* A common Indian Solitary Wasp. (India and Burma.)

ing out feeds upon the caterpillars. This wasp is much attacked by parasites, one of which is the cuckoo-wasp, *Chrysis fuscipennis* mentioned above. *Odynerus punctum*, another Indian species shown in Fig. 69, makes use of holes in door posts, &c., especially vacant ones made by large nails or screws. The hole is filled with provisions and the orifice is then covered over level with the surface of the wood so as to escape observation. This genus is said to be destroyed by *Chrysididæ*. The members of the genus Rhynchium also prey upon insects, usually selecting the interior of stems for their nests. *R. brunneum* (Fig. 70) makes use of hollow bamboo stems. Horne records a case in which a female of this species took possession of a stem in which the bee, *Megachile lanata*, had already built two cells. The wasp first constructed a partition of wood over the spot occupied by the bee, this partition being similar to that which it makes use of for separating the spaces intended for its own young. This species stores caterpillars intended for its young and this is also the habit of another Indian species, *R. nitidulum* (Fig. 71). This latter wasp constructs clay cells, similar to those of *Eumenes*, which it fixes firmly to wood.

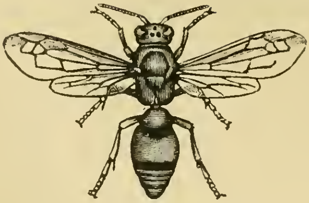

FIG. 69.—*Odynerus punctum* (Bengal).

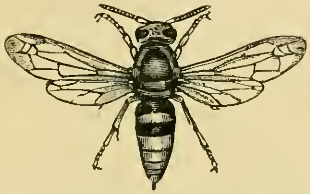

FIG. 70.—*Rhynchium brunneum*. (India).

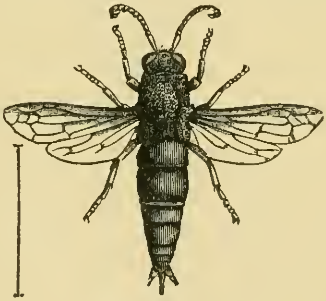

FIG. 71.—*Rhynchium nitidulum*. (Barrackpore.)

The social wasps (Vespidæ) live in colonies, as in the case of the social bees, consisting of males, females and workers. They build ingeniously constructed nests consisting of a paper-like substance composed of chewed wood or bark. These nests consist of one or more horizontal combs, each composed of a number of prismatic hexagonal cells open at their lower ends. These contain the larvæ, one in each, which thus hang head downwards. The whole nest may be surrounded by a firm or loose covering. The larvæ are fed upon chewed insects. The whole population of the nest dies in the late autumn with the exception of the young fertilised females. These survive through the cold weather months* and in the spring set about founding a new colony. The female commences the new nest by partially constructing a few cells and laying an egg in each. She then continues the building work until the young larvæ hatch out. These she is supposed to feed upon saccharine matter at first, subsequently giving them chewed insect food. In the intervals she continues the construction work and egg laying. This however naturally progresses slowly as long as the larvæ have to be fed. When these latter are full-fed they pupate and after a short time in this stage the adults, all workers, issue and at once carry on the construction of the nest as also the feeding of the larvæ and perhaps of the female herself. She now no longer engages in any work save egg-laying. The adult wasps feed chiefly upon sugary matter and fruit.

The nests of the Vespidæ are very elaborate structures formed of quite a different material to those of the bees; these latter, as we have seen, secrete wax and use it to build the comb, whereas the wasps make use of paper or card which they form from fragments of vegetable tissue, more especially woody fibre, amalgamated by means of cement secreted by glands; these vegetable fragments are obtained by means of the mandibles. In the case of our Indian wasps' nests the whole is enveloped in so solid and beautifully constructed an envelope of papier-maché (Fig. 72*d*), that they are enabled to pass through the heavy monsoon rains without injury. In most of the nests of the Vespidæ the comb is placed in stories, one above the other, the stories being in some cases held up by pillars made by the wasps, supported either by a branch or by the outside envelope, communication being effected by a hole in each layer of the comb, *e.g.*, as in *Vespa velutina* (Fig. 72) or there may be only one mass or comb, as, *e.g.*, in *Polistes*

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* This annual extinction of the nests is exceedingly curious since it does not appear to have any actual bearing upon the seasons or climate. In tropical climates where there is no cold weather the same thing occurs. De Saussure says: "The nests are abandoned without it being possible to discover the reason, for apparently neither diminution of temperature nor scarcity of food causes them (the Insects) to suffer. One is tempted to believe that the death of the Insects is the result of a physiological necessity." That this is not always the case however is proved by the fact that a large nest of *Vespa velutina* (?), attached to a big tree in Dehra Dun, remained active right through the winter up to the end of January and was apparently only killed off by the severe frosts experienced in February-March 1905 It was blown down with the branch to which it was attached in a severe storm in May of the same year.

(Fig. 74). The eggs are laid in the cells when the latter are only partially formed. The subsequent building up of the cell being accomplished as necessitated by the growth of the larva. The changes to pupa and imago take place after the cell has been entirely closed.

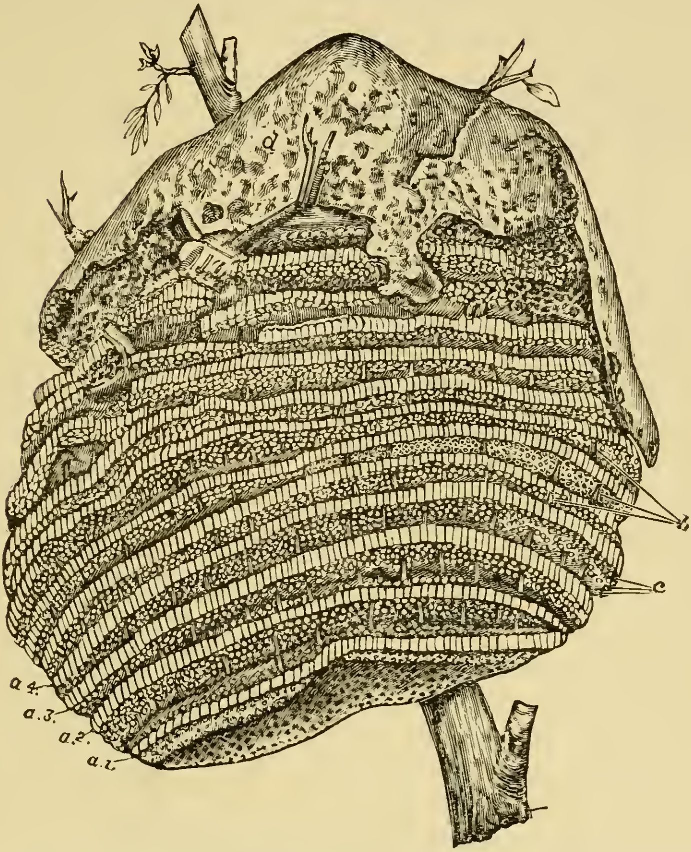

FIG. 72.—Nest of *Vespa velutina* (Dehra Dun.) a^1, a^2, a^3, a^4, layers of the comb; *b*, pillars supporting comb; *c*, larval cells; *d*, portion of the papier-machè envelope or covering; the rest has been removed. (Original.)

Perhaps the commonest of Indian Social wasps is the yellow *Polistes hebraeus* (Fig. 73). Every one knows the beautifully constructed papery nests of this insect. This wasp is particularly addicted to buildings and will attach its nests to rafters, door frames, in fact woodwork of any

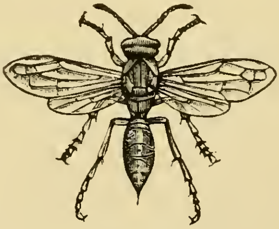

FIG. 73.—*Polistes hebraeus.* A common Indian Social Wasp. (Dehra Dun.)

description or to almost any convenient spot from its own point of view. The nest is unenclosed in any envelope; the hexagonal cells form an irregular comb or mass which is attached by a stalk near its centre, or more correctly the nest is constructed from a central basal attachment, the cells being so placed that their mouths look downwards. Fig. 74 shows a partially formed nest of this insect with a wasp clinging to it.

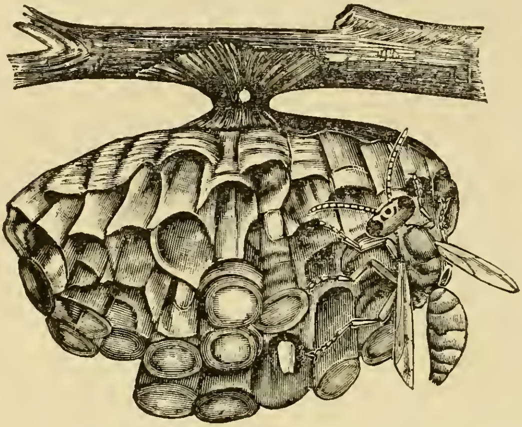

FIG. 74.—Nest of ***Polistes hebraeus***, with a wasp clinging to it. (Debra Dun.) (Original.)

Vespa velutina, the Indian hornet, builds nests of several feet in length which are inhabited by a very large number of individuals. Fig. 72 shows a fine nest of this species. The outer envelope is partially removed to show the formation of the stories of the comb.

The Indian hornet is very fierce when roused and will follow its enemy for miles even through dense jungle. Its sting in the hot weather is dangerous and may have fatal results in a similar manner to that of *Apis dorsata*. *Vespa magnifica* is the common wasp of the Himalayas from Simla to Darjiling extending into the hills of Assam, Burma and Tenasserim. *Vespa orientalis*, shown in Fig. 75, is to be found in the Punjab and United Provinces.

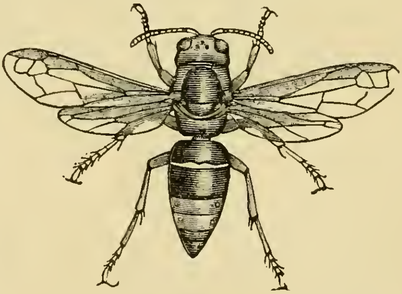

FIG. 75.—*Vespa orientalis* (United Provinces.)

Fam. XII. Fossoria—Sand Wasps.

Smooth bodied Insects, often with long legs; they are very like wasps, from which they may be distinguished by having their antennæ curled instead of elbowed; the front wings are not longitudinally folded. In habits they resemble solitary wasps, constructing either cells of clay or burrows in the ground or tunnels in the wood and stems of plants; others form no special receptacle for their young, being either parasitic or semi-parasitic or making use of the abodes of other Insects, holes, etc. The habits of these Insects are carnivorous, the cells, burrows, &c., formed being filled with Insect stores to serve as food for the next generation. These Insects exhibit a wonderful industry and skill in the preparation and stocking of their cells and a remarkable variety in their habits, more especially marvellous when it is remembered that they never see their progeny and thus the young can have learnt nothing from their parents. Over 2,000 years ago these Insects attracted attention and Aristotle made some observations on them. A curious Chinese tradition supposes that the Insects forming and storing the cells are males and that having buried the caterpillar it addressed a spell to it enjoining it to come out as a wasp similar to itself. This tradition, ancient as it may be, is by no means confined to China. Many instances of similar belief may be found in India at the present day.

The *Scoliidæ* are parasitic Fossoria and are large powerful hairy insects with thick legs; their colour is usually black with bands or spots of red and yellow; the hind body is elongate and has only a very short pedicel. Little is known about the habits of these insects in India. It is not improbable that, as with their European confrères, they are parasitic upon the larvæ of Lamellicorn beetles; these latter larvæ live in the soil or in accumulations of debris and the female Scolia enters the ground and, first stinging the grub, lays an egg in it. The Scolia grub feeds upon its host on hatching out, the latter remaining alive for a considerable time. *Scolia procer* (Fig. 76) is a common Indian insect.

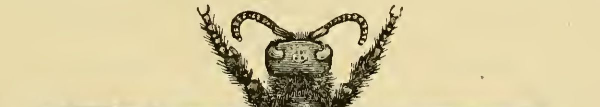

FIG. 76.—*Scolia procer.* (India and Burma.)

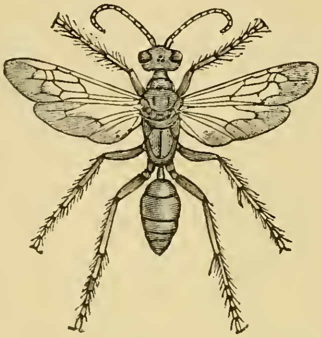

Fig. 77.—*Sphex lobatus.* (India.)

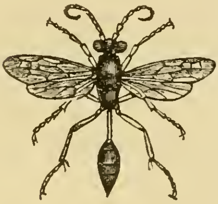

Fig. 78.—*Pelopœus* (*Sceliphron*) *madraspatanus.* The mud-dauber (N.-W. India.)

The *Sphegidæ* form their nests in burrows or construct mud cells. *Sphex lobatus* (Fig. 77) is an Indian insect which provisions its nest with *Orthoptera*. Rothney noted that a large field cricket (*Brachytrupes achætinus*?) was made use of. *Pelopœus* (*Sceliphron*) *madraspatanus* is common in N.-W. India and is often known as the 'mud-dauber' (Fig. 78). It builds its cells all over the house but most often in the inhabited rooms and is quite fearless. The cells are 4 to 6 in number and are usually provisioned with spiders, about a score or so in number. The edifice is disguised when completed so as to make it look like a daub of mud.

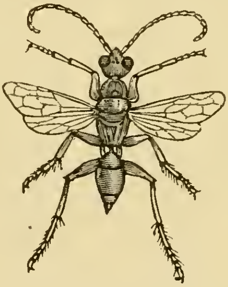

Fig. 79.—*Ampulex compressa.* (India and Burma.)

Ampulex compressa, another Indian species, Fig. 79, makes use of cockroaches as provisions for its young. It does not construct any special cell but makes use of holes, &c.

Fam. XIII. Formicidæ—Ants.

The antennæ are elbowed and trochanters undivided. The ants can be distinguished from other Hymenoptera by the fact that they have a constriction in the stalk which joins the abdomen to the thorax. The individuals of each species are usually of three kinds, males, females and workers, the latter which are the most usually noticeable of the three are wingless, but the males and females are winged, though the females soon lose their alar appendages. They are social Insects living in communities of various members, the majority being workers.

The larvæ are helpless maggots, fed and tended by the workers or by the females. The pupæ are enclosed in silken cocoons, these being the popularly called 'ant's eggs' which may be seen in fine weather exposed on the top of the nest.

Ants build nests which consist of passages and chambers dug out in earth and rotten wood, stumps of trees, etc., or they may build in the crowns of trees or bushes amongst the leaves which they fasten together. The burrowing ones generally pile up the earth they dig out in hillocks and mounds above the level of the surface of the ground.

The two most important sub-families of the ants are the *Formicides,* which have only one knot in their peduncle, the abdomen being usually not furnished with a sting (Fig. 80), and the *Myrmicides* with two well-marked knots in the peduncle, the abdomen being usually furnished with a sting.

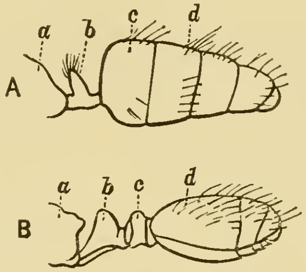

FIG. 80.—Abdomens of ants. A. *Formicides* with one joint, *b*, to peduncle. B. *Myrmicides*, with two joints *b*, *c*, to peduncle.

An example of the Formicides is the large vicious red ant, *Œcophylla smaragdina* (Fig. 81), of India. This ant inhabits trees, making a nest of the leaves which are fastened together. Mr. E. E. Green has recorded a peculiar habit of this ant. The adult has no material to enable it to fasten the leaves together, but the larva possesses glands which secrete a sticky substance. Several ants hold the leaves together whilst others, each holding a grub between its mandibles, use it to serve as an animated gum bottle to stick the edges of the leaves together. Fig. 81 shows an ant holding a larva in this manner.

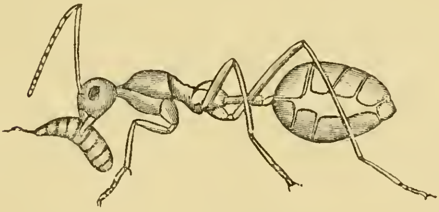

FIG. 81.—*Œcophylla smaragdina.* The red ant of India. Worker using a larva for spinning. (After Sharp.) (India.)

Another species is the large black ant, *Camponotus compressus* (Fig. 82), which constructs its nest in the ground. This ant attacks other ants and is also to be found in attendance sucking up the sweet excretions of blights (*Aphidæ*) and scale insects (*Coccidæ*). Although plentiful where it occurs it is but locally distributed throughout the country.

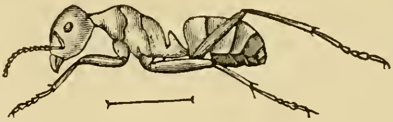

FIG. 82.—*Camponotus compressus.* (India.)

Amongst the Myrmicides may be noticed a large fierce insectivorous ant, *Sima rufonigra*, called the sepoy-ant (Fig. 83) in Madras from its colouration, it having a red thorax and black head and body. It makes its nests in dead wood and is often found in old longicorn beetle borings in sandalwood in Coimbatore and Mysore. Its sting is exceedingly painful. It is equally common in the north of India. Bingham *writes as follows on this ant :—'*S. rufonigra* makes its nests in the dead wood of trees, and very often, in Burma at least, in the clefts of the beams and posts of the wooden rest-houses scattered over the country. Personally, I opened and examined only one nest, and that was in a hollow in a Pyinkado tree. The hollow was low down in the tree, and the entrance or entrances, for there were several, were quite at the base of the tree.' This ant at times fights most fiercely with the red ant (*Œcophylla*) described above.

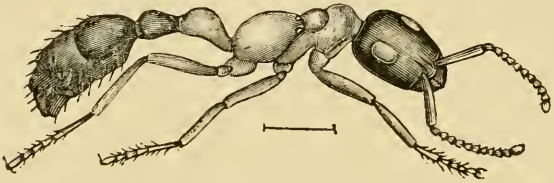

FIG. 83 —*Sima rufonigra.* The sepoy-ant. (Coimbatore.)

The common red ant of the plains of India, *Solenopsis geminata*, (Fig. 84) lives in large colonies in nests in the ground, under stones, &c. It constructs partially covered ways across roads and is often to be seen carrying off dead insects. It has been reported as attacking potatoes and may do damage in nurseries.

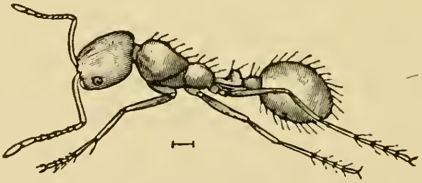

FIG. 84.—*Solenopsis geminata.* (India.)

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* Bingham, Blanf. Faun. Br. Ind., Hymenoptera, Vol. II, 109.

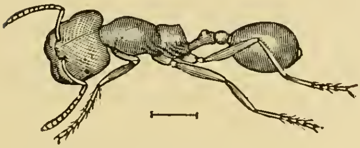

FIG. 85.—*Holcomyrmex scabriceps* A granary ant. (Punjab.)

Another example of this group is one of the granary ants *Holcomyrmex scabriceps* (Fig. 85) which builds its nests in the ground and stores up grass and other seeds. Quite large heaps of grain are collected by these Insects, these heaps being either used as food as they are or allowed to ferment, the ants feeding upon the sugar contained in the fermenting mass. This ant is distributed irregularly throughout India from the Punjab to Cochin, but has not been recorded from Ceylon, Assam or Burma.

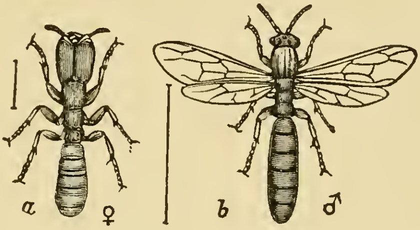

FIG. 86.—*Dorylus orientalis.* A vegetable-eating ant, ♂ and ☿ forms. (Botanical Gardens, Calcutta.)

The sub-family Dorylinæ with large yellow-winged males and small flattened yellow workers are carnivorous hunting ants as also are the *Ponerinæ*. The only exception to the carnivorous rule in the two sub-families is the ant *Dorylus orientalis* which has been reported as attacking potatoes and cornflour plants at the Botanical Gardens in Calcutta. M. Forel, who has identified the ant on several occasions, writes that it appears almost incredible that this ant should be the only vegetarian in the two sub-families. Fig. 86 shows the ♂ and ☿ forms.

Some ants are in the habit of keeping *Aphidæ* in their nests, which they use much as we use cows, sucking up the sugary secretions emitted by the blight. It is a common observation that when rose bushes and fruit trees are seen to bear blight upon their branches a procession of files of ants will be found crawling up the bushes or trees, their object being to suck up the sugary sap given out by the blight.

Useful Hymenoptera.

The Hymenoptera include several families containing species of direct benefit to man since they parasitise, and therefore tend to keep in check, various injurious pests both in the field and forest. It must however be borne in mind that the good is in some cases almost counterbalanced by the fact that the same families contain Insects which are parasitic upon, and therefore lessen the numbers of, our useful Insect friends. In spite of this, however, in the case of serious increases in the numbers of an Insect pest such as a plague of caterpillars, or abnormal increases in plant lice (*Aphidœ*) and scale Insects (*Coccidæ*), &c., man is often deeply indebted to his hymenopterous allies. In this respect the *Chalcididœ* undoubtedly stand out prominently; it has already been ascertained that the family contains species of undeniable importance and the further study of the group in India will well repay the trouble expended upon it. We have seen (in Chapter V) that members of the family attack such different pests as the sugarcane borer (*Chilo simplex*), the tea scale bug (*Chionaspis theæ*), the so-called cheroot weevil (*Lasioderma testaceum*) and tea and sal leaf defoliating caterpillars. Other species have been found parasitic upon blue pine (*Polygraphus*, *Pityogenes*,) and deodar (*Scolytus*) pests. It has also been discovered, however, that it contains members which are parasitic upon beneficial Insects as, *e.g.*, *Perilampus* considered to be parasitic upon some dipterous friends. Next to the *Chalcididœ* we may mention the *Ichneumonidæ*, which are *par excellence* a parasitic group, more especially affecting the caterpillars of *Lepidoptera*. This family likewise is not entirely a beneficial one since it commits a considerable amount of injury amongst silkworms reared by man for their products, and this injury at times involves heavy pecuniary loss. Defoliating pests of all kinds are kept in check however, such as the *Lymantrias* of the tea and sal tree by *Chalcis euploea*, *Acronycta anœdina* of the horse chestnut by *Ophion aureolatus*; *Hyblœa puera* the common teak defoliator by species of *Glypta*, *Pimpla*, &c.; defoliating *Saturniidae* by *Pimpla punctator*; the wheat and rice weevil by *Pteromalus oryzæ*, &c. Although essentially a Lepidopterous larva-parasiting group, the *Ichneumonidœ* do not, however, confine themselves to caterpillars. The genera of magnificent Insects known as Thalessa and Rhyssa attack wood-feeding grubs and are in consequence of considerable importance in the forest and orchard on this account. We have seen that a species of Rhyssa is parasitic upon the fine sirex wood-borer of Spruce (*Sirex imperialis*). Little is at present known about the parasitic family *Proctotrypidæ* which contains however the important Insect *Platygaster oryzæ* which is parasitic on the rice fly pest (*Cecidomyia oryzæ*) or of the *Braconidæ* which greatly resemble the true *Ichneumonidæ*. Both these families will certainly yield surprising instances of their value to man when they have been studied.

In addition to the groups of Insects of direct value to man as indispensable allies, the *Hymenoptera* includes others whose usefulness comes from quite a different cause; these groups minister to his physical wants, providing him with certain products such as honey and wax, suitable as articles of food and commerce. The family *Apidæ* contains the greater number of these Insects such as *Apis dorsata* and *indica* considered above. The *Apidæ* play yet another important part in nature. The Insects largely depend upon the nectar of flowers and pollen for their food supplies and to obtain it visit, and often enter, the corollas of flowers. In this way they distribute the pollen, by serving as carrier, from plant to plant and consequently play a great part in the fertilization of the flowers and the ultimate fructification of the plant. The great usefulness of bees and many other Insects in this respect is by no means adequately recognised.

The *Diploptera* (wasps) and the *Fossoria* (sand-wasps) also attack caterpillars and other Insects, paralysing them and subsequently laying their eggs in the body and they may therefore be termed useful insects. The sand-wasps also attack grasshoppers, laying their eggs in Insects of this nature of several times their own bulk. For instance *Sphex lobatus* attacks the large cricket *Brachytrupes achœtinus* which has already been shown to be a pest in India.

Little is known about the usefulness or otherwise of the *Scoliidæ* in India, but in Madagascar a species lays its eggs in the rhinoceros beetle (*Oryctes*) which attacks palms in the island. It may turn out that a species infests and keeps in check the *Oryctes* in India which is a serious pest to date and cocoanut palms in Bengal, Madras and Bombay.

Our knowledge of the habits of the *Formicidæ* in India is not as yet sufficiently extensive to enable any definite remarks to be made upon their usefulness to man or otherwise. The bamboo-ant, *Œcophylla smaragdina*, feeds largely upon caterpillars, and so is possibly of some use in keeping down defoliating pests.

From the above remarks it may be said that, taken as a whole, the Order *Hymenoptera* must be considered as one of considerable usefulness to man.

(To be continued.)

BIRDS OF SEISTAN,

BEING A LIST OF THE BIRDS SHOT OR SEEN IN SEISTAN BY MEMBERS OF THE SEISTAN ARBITRATION MISSION, 1903-05.

By
J. W. NICOL CUMMING,
Superintendent, Seistan Arbitration Commission.

1. THE RAVEN. (1) *Corvus corax.*

I saw three specimens of a large Raven at Kubak on the 25th September 1904, and a pair near Hurmak on the 18th May 1905, which I believe belonged to this species.

2. THE CARRION-CROW. (3) *Corvus corone.* (Persian Kolagh.)

This is a common bird in Seistan during the winter and is frequently seen near dwellings. I shot a specimen on the 20th March 1905.

3. THE ROOK. (5) *Corvus frugilegus.*

Is seen in large flocks in fields during the winter.

4. THE HOODED CROW. (6) *Corvus cornix.*

This Grey Crow is found mostly in the tamarisk jungles of Seistan in twos and threes; but at times, during the winter, large flocks are to be seen in the open fields.

5. THE MAGPIE. (10) *Pica rustica.* (Persian, Duzd, *i.e.*, a thief.)

Not very numerous in Seistan. It is occasionally seen either singly or in pairs in, or near, the tall tamarisk jungles with which the country abounds.

6. THE COMMON BABBLER. (105) *Argya caudata.*

(Biluchi, Pinkulag; Persian, Susu.)

Very common in the tamarisk jungles, where, however, it is extremely shy. A specimen I shot on 25th April 1905, at Kuhak, measured 9·25' in length. Breeds in the country.

7. THE WHITE-EARED BULBUL. (285) *Molpastes leucotis.*

(Persian, Bulbul.)

During my visits to Nasratabad, the capital of Seistan, in January and April 1905, I saw several birds which appeared to belong to this species; but I was unfortunately unable to secure a single specimen.

8. THE WALL-CREEPER. (348) *Tichodroma muraria.*

I have seen only two of this pretty crimson-winged Wall-Creepers while on the Seistan Arbitration Mission, *i.e.*, at Nad Ali on 7th March 1903, and again at Peshàwaràn, 12 miles north of Seistan, on the 20th December 1904, when I managed to shoot the latter, a female.

9. THE GREY-BACKED WARBLER. (359) *Aëdon familiaris.*

(Biluchi, Surkhdumak.)

Very common. I shot a specimen (length 6·5) at Kuhak, Seistan, on the 22nd April 1905, on the banks of the Rud-i-Seistan, while 5 eggs with a live bird (length 6·0) were brought to me on 11th May 1905.

10. THE DESERT TREE-WARBLER. (397) *Hypolais obsoleta.*
(Biluchi, Gaz burruk.)

I have frequently seen this bird in the low bushes on the "dasht" near the Rud-i-Seistan and shot a male specimen on the 20th March, and another on the 27th April 1905, near Kuhak. The measurements of the latter are as follows:—length 5·0; wing 2·37; tail 2·12; tarsus ·75; bill from gape ·62; middle toe and claw ·43; distance from tip of first primary to tip of wing 1·25; distance from tip of secondaries to tip of primaries ·5.

11. THE EASTERN ORPHEAN WARBLER. (399) *Sylvia jerdoni.*
(Biluchi, Gaz burruk.)

This bird is fairly common in the tamarisk jungles fringing the Helmand and its branches. I shot a male specimen on the banks of the Rud-i-Seistan, near Kuhak, on 21st March 1905.

12. THE STREAKED WREN-WARBLER. (462) *Prinia lepida.*

Fairly common in the tamarisk jungles. I found a nest with 4 eggs at Kuhak on 29th March 1904, and shot a specimen at Kuhak on the 1st October 1904.

13. THE RUFOUS SHRIKE. (480) *Lanius phœnicuroides.* (Biluchi, Dik.)

I noticed several of this species on the banks of the Rud-i-Seistan on 22nd April 1905, when I secured a specimen (length 7·25).

14. THE COMMON INDIAN STARLING. (532) *Sturnus menzbieri.*

I have on more than one occasion seen flocks of starlings in Seistan, which, I believe, belonged to this species; but not having secured any specimens I cannot be certain about it.

15. THE COMMON PIED BUSH-CHAT OR WHITE-WINGED
BLACK ROBIN. (608) *Pratincola caprata.*

A pair of live birds was brought to me with their nest and two fresh eggs, at Kuhak, on the 7th May 1905. The female was not grey, as stated at page 60 of Vol. II of the Fauna of British India, nor dusky brown as stated by Lieut. H. E. Barnes at page 199 of his "Birds of Bombay"; but its entire upper surface (excluding rump), head, neck, upper breast, tail and wings were a rich brown. The rump was rufous, chin whitish, and bill, legs and feet nearly black. Prior to this I had seen a solitary male at Kuhak on the 23rd April 1905.

16. HUME'S CHAT. (617) *Saxicola albinigra.*

A couple of these birds was to be seen in the Mission Camp at Kuhak for several days during March 1905. They were first noticed by me on the 12th of March, and were usually to be seen perched on buildings and walls. I avoided shooting them in the hope that they had come to breed, but after some time they disappeared.

17. THE WHITE-HEADED CHAT. (619) *Saxicola capistrata.*

I have seen only one of these birds in Seistan, which I shot, at Kaod, on the 26th March 1903.

18. THE ISABELLINE CHAT. (625) *Saxicola isabellina.*

This Chat was fairly common in Seistan during the spring of 1905. Specimens were obtained by me close to the Rud-i-Seistan, at Kuhak, on the 31st March and 3rd April. Two of these measured 6·5" and 6·75" in length.

19. THE DESERT CHAT. (626) *Saxicola deserti.*

A specimen was secured by the Mission Taxidermist, at Khwaja Ahmed, in January 1905.

20. THE BLACK BIRD. *Turdus merula.*

While at Nasratabad, on 23rd January 1905, I saw a bird from a distance, in the moat round the city fort, which very much resembled the black bird. It disappeared before I could get a near view of it.

21. THE TREE-SPARROW. (779) *Passer montanus.*

Though ordinarily known as the Tree Sparrow, this species was to be found in every building in the Mission Camp, at Kuhak, in April 1905. I did not notice any in the month following, when they appear to have entirely deserted these buildings.

22. THE SWALLOW. (813) *Hirundo rustica.*

Common in Seistan during spring and summer. The first bird to arrive in the Mission Camp, in 1905, was on the 14th March. In 1904 they began laying during the last week in March, making the usual cup-shaped mud nest in any building to which they had access. I came across no nests in 1905. This was probably due to the uncertain state of the weather, a reversion to winter having set in during the last week of March which caused most of the birds to disappear, at any rate from the buildings which they had begun to take possession of.

23. THE MASKED WAGTAIL. (829) *Motacilla personata.*

I have seen only one specimen of this bird, which I shot on the banks of the Helmand opposite the Band-i-Seistan, near Kuhak, near some grazing camels, on the 28th April 1905. It measured 7·37 in length. I have no reason to think it uncommon in Seistan, which abounds in Wagtails.

24. THE GREY WAGTAIL. (832) *Motacilla melanope.*

25. THE GREY-HEADED WAGTAIL. (833) *Motacilla borealis.*

26. THE BLACK-HEADED WAGTAIL. (836) *Motacilla feldeggi.*

The three preceding varieties of Wagtails are very common in Seistan. On 23rd April 1905, I noticed quite a large number of the three varieties in among a flock of sheep which were grazing off the grass-covered banks of the Rud-i-Seistan. They were attracted by the numerous insects which were being disturbed by the sheep, and kept up with them partly by walking and partly by flying. These birds were by no means shy, and allowed me to approach within a few feet, so that I had a good opportunity of examining them closely.

27. THE DESERT-LARK. (854) *Alæmon desertorum.*

Found throughout the year on the gravel-strewn "dashts" of Seistan where it breeds, a young bird having been brought to me, at Kuhak on the 13th May 1904. This species is usually seen singly or in pairs, except in September, when

I have seen as many as six together, presumably a whole family. I shot specimens on 21st September 1904 and 5th May 1905. The latter measured 9·65 inches in length.

28. THE CRESTED LARK. (874) *Galerita cristata.*

(Biluchi, Chagok ; Persian, Kamalak.)

Most abundant about the grass-covered banks of the Helmand and its branches, where it breeds from March to June, nests having been seen by me on the 27th March 1904, 20th April 1905, 29th April 1903, and on 16th May and 13th June 1904. About September they leave the grassy banks of the rivers and spread all over the "dasht". A specimen I shot on the 20th April 1905 measured 7·4 in length. On 23rd March 1905 I winged, but unfortunately lost, a crested lark with two conspicuous white feathers in its tail, presumably a freak of nature.

29. THE DESERT FINCH-LARK. (878) *Ammomanes phœnicuroides.*

(Biluchi, Dasht-i-Chagok.)

Fairly common on the "dasht" near Kuhak, where I frequently came across small flocks of them during March and early in April 1905. On 24th April 1905 I saw them in pairs near Kuhak, when I managed to secure a specimen. The same day I saw a bird carrying off some material for its nest. Later on, during May and June, I saw solitary birds, on several occasions, along the Nushki Trade Route on the return of the Mission to Quetta. Owing to its colour, this bird is not very readily noticeable.

30. THE EUROPEAN ROLLER. (1024). *Corracias garrula.*

(Biluchi, Sabzkarask.)

A live specimen was brought to me at Khwaja Amad in April 1903, and on the 24th April 1905 I found the country swarming with them, when I shot a specimen, length 13 inches. These birds were passing through and travelling in a northerly direction.

31. THE BLUE-CHEEKED BEE-EATER. (1028) *Merops persicus.*

(Biluchi, Kurru.)

Very numerous in Seistan during the summer. They arrive in the country from a westerly direction in April—the earliest arrivals in 1905 being on the 17th of that month, and leave about October. I shot a specimen, at Kuhak, on the 22nd April 1905 (length 12·25) and found a pair boring their nest in a low vertical sandy cliff facing west, on 7th May 1905, near Khwaja Ahmad. I was given to understand by the Biluchis of the country that they usually breed in the banks of the Rud-i-Seistan, where they are to be found perching on the swaying branches of the overhanging tamarisk and tall grasses which grow so luxuriantly thereon.

32. THE COMMON KINGFISHER. (1035) *Alcedo ispida.*

This little Kingfisher is common all over Seistan and appears to be a permanent resident.

33. THE EUROPEAN HOOPOE. (1066) *Upupa epops.*

(Biluchi, Murgh-i-Suleman.)

I have seen several Hoopoes during the stay of the Mission in Seistan, hanging about holes in walls during the summer months and believe they belonged to this species. I regret not having shot any specimens.

34. THE SYKES'S NIGHTJAR. (1089) *Caprimulgus mahrattensis.*

(Biluchi, Shapkor.)

I have come across only this one species of Night Jar in Seistan and that very numerous during the summer months, *i.e.*, from April to September, when it is to be seen all over the country flying about at dusk. It usually breeds on the gravel-strewn "dasht", laying no more than two eggs on the bare ground. These are glossy, of a light-grey colour and blotched with pail purplish grey. Owing to its colour it is extremely difficult to distinguish the bird when on the ground, even during the day, and when seated on eggs it keeps so still that it, at times, barely escapes being trod upon. I saw a couple pairing at dusk on the 4th May 1905 and had previously taken their eggs at Kuhak on the following dates:—

On 24th May 1903	2 eggs.
On 19th April 1904	2 do.
On 28th do.	1 egg.
On 2nd June 1904	2 eggs.

On two occasions, *i.e.*, on 21st and 23rd May 1904, reports were brought to me by different parties that the eggs of this species had been seen; but on proceeding to the localities where they had been seen, no trace either of the eggs or the bird could be found. I had no reason to believe that either party was trying to deceive me, as it meant loss of reward to the informers if no eggs were forthcoming. The absence of both eggs and bird in both instances, therefore, tends to the conclusion that this bird is in the habit of carrying its eggs about from place to place when necessary. No regard appears to be shown as to suitability of site, as two eggs I found were laid between two parallel camel tracks only a few feet apart. A young bird was also brought to me on the 28th June 1904.

The cry of the bird very much resembles that of a frog and is to be distinctly heard all over the "dasht", after sunset, when the bird can be very easily located.

35. THE ROCK HORNED OWL. (1168) *Bubo bengalensis.*

(Biluchi, Boom.)

A badly injured live young bird not quite fully fledged and with wing and tail-feathers mostly plucked was brought to me at Kuhak, from Shaharistan, on the 6th May 1905. I concluded it belonged to this species, not only from its large size and the colouration of such of the feathers as it possessed, but chiefly from the fact that its last toe-joints were naked. It had no "horn tufts"; but these may have been plucked by the Seistani children into whose hands the unfortunate bird fell, if they had had time to develop.

36. HUTTON'S OWLET. (1182) *Athene bactriana.*

I have seen only one of these birds in Seistan, which I shot, near Kuhak, on the 21st October 1904, on a high bluff near the Rud-i-Seistan.

37. THE EGYPTIAN VULTURE, OR LARGE WHITE SCAVENGER VULTURE. (1198) *Neophron percnopterus.*

I have occasionally seen this species not only by itself near Kuhak and elsewhere in Seistan, but also in company with other larger vultures which, I regret to say, I did not identify at the time.

38. PALLAS'S FISHING-EAGLE, OR THE RINGED-TAILED SEA EAGLE. (1223) *Haliaëtus leucoryphus.*

On 12th January 1905 I saw a pair of birds, on the high bluffs bordering on the Hamun-i-Sabari, between the Farrah Rud and Kuh-i-Gach, which very closely resembled this species.

39. THE BLACK KITE. (1231) *Milvus migrans.*

I have seen several kites in Seistan which very closely resembled this species, but never secured a specimen.

40. THE COMMON BUZZARD. (1241) *Buteo desertorum.*

A specimen was shot at Reg Mori on 27th February 1904.

41. THE INDIAN BLUE ROCK-PIGEON. (1292) *Columba intermedia.*

(Biluchi, Kapoth ; Persian, Kaftar.)

Several Blue Rock Pigeons were shot by Major H. F. Walters off the high cliffs near Puzak, on 3rd February 1904 ; but there appears to be some uncertainty as to whether they belonged to this species or to the European variety (*C. livia*). I, however, subsequently, shot a specimen (a female) of *C. intermedia* at Kuhak on the 22nd April 1905, measuring 13·37 in length.

42. THE BLUE ROCK-PIGEON (1293) *Columba livia.*

See foregoing.

43. THE EASTERN STOCK-PIGEON. (1295) *Columba eversmanni.*

(Biluchi, Kapoth or Chah-i-Kapoth ; Persian, Kaftar.)

The only specimen I ever saw in Seistan was shot by myself at Kuhak on 28th April 1905. It measured 11·12 inches in length.

44. THE INDIAN RING-DOVE. (1310) *Turtur risorius.*

(Biluchi, Jungli kapoth.)

A live, but very badly injured and plucked, specimen was brought to me at Kuhak on the 7th May 1905. I have myself seen very few doves in Seistan.

45. THE LARGE OR BLACK-BELLIED SAND-GROUSE. (1316) *Pterocles arenarius.* (Biluchi, Jhugor ?)

I have seen and heard large numbers of Grouse in the distance, near Kuhak, but never shot any. I am informed, however, that the Imperial Sand Grouse is procurable in Seistan.

46. THE SPOTTED SAND-GROUSE. (1322). *Pteroclurus senegallus.* (Biluchi, Kuttu.)

See foregoing. I am informed by those who have shot Grouse in Seistan that they comprise only two varieties, *i.e.*, the Black-bellied and the Spotted Sand Grouse, the latter being the more numerous.

47. THE COMMON OR GREY QUAIL. (1355) *Coturnix communis.* (Biluchi, Karrak.)

This appears to be the only Quail found in Seistan. At any rate it was the only variety shot by the officers of the Mission. It was fairly numerous among cultivation during the autumn of 1903 and spring of 1904. The largest bag which fell to one gun was 12 brace. During the severe and prolonged winter of 1904-05 it was very scarce. Nests were obtained on the following dates :—

22nd March 1904, at Zahidan (1 fresh egg).
30th March 1904, at Kuhak (do.).
25th April 1904, at Kila-i-Konah (10 eggs in one nest).

48. THE SEESEE. (1371) *Ammoperdix bonhami.*

This bird appears to be rather scarce in Seistan, a few only having been seen on the mud bluffs at the edge of the "dasht" near Kuhak. The only specimen shot on this Mission was at lower Khwaja Ali on the Helmand on 7th February 1903, while I saw a few birds at Peshawaran, 12 miles north of Seistan, on 20th December 1904.

49. THE BLACK PARTRIDGE OR COMMON FRANCOLIN. (1372) *Francolinus vulgaris.* (Biluchi, Port.)

An extremely common bird throughout Seistan. It affords splendid sport, the largest bags which fell to two guns* in one day being 28 brace on 14th October 1904, and 22½ brace on 23rd November 1904, at Milak. The extensive tamarisk jungles which cover the banks of the numerous streams in Seistan provide ample protection against the extermination of this bird by the people of the country, who have no respect for the breeding season. The plan usually adopted by the Seistani for its destruction is ingenious, if primitive. When out shikaring, he usually carries about with him, in addition to his muzzle-loader and pumpkin flasks containing powder and shot, a large square piece of khaki-coloured cloth, with a hole cut out in the centre some 5″ or 6″ in diameter. This cloth he usually carries stretched out before him as a screen, two tamarisk boughs tied in the centre in the form of an x being used for the purpose. On observing his quarry, he rests the screen on the ground and fires from behind it through the opening. Numerous birds are also captured by means of traps of various patterns, in making which the Biluchi, especially, is very clever, the material used being tamarisk boughs or twigs, sheep's horns and home-made twine.

The Black Partridge is a permanent resident in the country and breeds from April to June, eggs having been brought to me at Kuhak on the following dates :—

21st April 1904 (9 fresh).
23rd May 1904 (5 fresh).
4th June 1904 (4 fresh).
6th June 1904 (10 highly incubated).

The eggs obtained on the 6th June 1904 I had placed under a fowl and they were hatched on the 9th June.

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* Major T. W. Irvine, I.M.S., and Captain R. C. Bell.

50. The Little Crake. (1392) *Porzana parva.*

I expect this bird must be numerous in the dense reeds and rushes forming the Naizars. I have, however, seen only one specimen (a female), which was brought to me on the 6th September 1904.

51. The Purple Moorhen. (1404) *Porphyrio poliocephalus.* (Persian, Bistuni.)

Numerous in the dense reeds and rushes of the Naizars, where the water is shallow, but it is very rarely seen. It is a permanent resident in Seistan. On 13th June 1904, Lala Thakurdass, Irrigation Surveyor attached to the Mission, sent me a young live bird, about six weeks old. He also obtained two full-grown live birds at Koh-i-Khwaja in January 1905, which took very kindly to captivity and stalked about freely with some poultry kept by the Mission boatmen.

52. The Coot. (1405) *Fulica atra.* (Persian, Chor.)

Very numerous both in the reeds and rushes of the Naizars and on the open stretches of water forming the Hamuns. It is a good swimmer and diver, and is to be seen, at times, in large flocks congregating with duck of all sorts. The Coot is a permanent resident and breeds in the Naizars. Lala Thakurdass, Irrigation Surveyor, on 14th March 1904 found several of their nests near Adimi, and brought in three. Two of these contained nine eggs each, and the other eight. Some of the eggs were fairly well incubated, while the others were fresh. The nests, which were huge masses of dry rushes, were not found floating on the surface of the water, but were supported about 2 feet above the surface by the dense reeds in which they were placed and which grew there in water about 7 feet deep.

53. The Demoiselle Crane. (1411) *Anthropoides virgo.*

A specimen of this Crane, the only one secured by this Mission that I am aware of, was shot by Colonel A. H. McMahon, C.S.I., C.I.E., on the banks of the Helmand at lower Khwaja Ali, on 7th February 1903. A flight of these cranes was, however, subsequently seen by me, passing over Mission camp at Kuhak, on 30th March 1905.

54. The Houbara. (1415) *Houbara macqueeni.* (Persian, Thukdar and Thukdarri; Biluchi, Charz and Charras; Pashtu, Sára and Sáre; Hindustani, Tiloor.)

This Bustard is fairly plentiful in Seistan during the spring, being found on the dasht salt-covered plains and sand hills near cultivation. Four birds were trapped by Seistanis near Ziarat-i-Bibi Dost between Zahidan and Nasratabad and brought into camp at Kuhak on 18th March 1905. Several were subsequently seen about Sabzkim, Zahidan and elsewhere. The Biluch Nomad, who professes to know something about the nidification of birds, state that this Bustard breeds in Seistan about the middle of May, when the crops are being cut. This may be correct as regards Seistan, but it does not correspond with the only find of this bird's eggs that I know of. When I was in Fao, on the Shatel Arab in 1884, the Sheikh of Koweit sent in 8 eggs of this Bustard on the 8th of March. Every effort was made by me and others to procure the eggs of this Bustard in Seistan, but without success.

55. THE GREAT STONE-PLOVER. (1419) *Esacus recurvirostris.*

Two slightly incubated eggs, corresponding in colour and markings to eggs I have in my collection and measuring 2·06 by 1·5, were found at Kuhak by some camel men not far from the Rud-i-Seistan, and brought to me on 5th June 1904. This is a little later than finds recorded in India, where according to Blanford, the Great Stone Plover lays between February and May, though I myself once discovered two highly incubated eggs as late as 3rd June on the seaborder, at Karachi, in 1887. This, however, was due to my unwittingly having destroyed a down-covered bird, which I came across at dusk, on the 28th April 1887. Keeping a regular look out for the parent birds, I found that they did not desert the locality, and that, having been deprived of their only offspring—there was only one—they laid again.

56. THE CREAM-COLOURED COURSER. (1423) *Cursorius gallicus.*

This Plover is to be found all along the Helmand and its numerous branches. I saw a small covey between Lower Khwaja Ali and Landi Barechi on the 10th February 1903 and two live birds were sent to Colonel A. H. McMahon, C.S.I., C.I.E., at Nad Ali, on the 5th March 1903. I have also seen them in Seistan in April, so that they must breed in the country.

57. THE LAPWING OR PEEWIT. (1436) *Vanellus vulgaris.*

Procurable in Seistan, though I have not myself shot any specimen.

58. THE WHITE-TAILED LAPWING. (1438) *Chettusia leucura.*

The only specimen I have seen in Seistan was one shot and sent me by Mr. E. A. McManus, of the Indian Government Telegraph Department, from Nasratabad, on the 6th May 1905. It was a male and measured 11·25″ in length.

59. THE GOLDEN PLOVER. (1440) *Charadrius pluvialis.*

This bird has been seen by some of the officers of the Mission in Seistan, but it does not appear to be very common.

60. THE LITTLE RINGED PLOVER. (1447) *Ægialitis dubia.*

This Little Plover is rather plentiful along the banks of the rivers and streams. I shot a specimen (length 6″) on 1st April and a second on 9th May 1905 near Kuhak and have seen others during the summer, when I feel sure the bird must breed in Seistan.

61. THE BLACK-WINGED STILT. (1451) *Himantopus candidus.*

A solitary female I shot near Khwaja Ahmad on 24th April 1905, measured 14″. I subsequently, *i.e.*, on 13th May 1905, received two birds shot by Mr. McManus, of the Telegraph Department at Nasratabad.

62. THE CURLEW. (1454) *Numenius arquata.*

Very common along the shores of the Hamuns during the winter. I have not seen any during the summer months and so am unable to say whether this species stays to breed in Seistan or not.

63. THE BLACK-TAILED GODWIT. (1456) *Limosa belgica.*

On the 6th May 1905 Mr. E. A. McManus, of the Government of India Telegraph Department, managed to secure for me a specimen of this bird at Nasratabad out of a flock of some 20. It measured 18·25″ in length.

64. THE WOOD OR SPOTTED SANDPIPER. (1461) *Totanus glareola.*

Numerous in Seistan during May. I shot a specimen (length 8·37″) on 5th May 1905 near Khwaja Ahmad, while Mr. E. A. McManus, of the Telegraph Department, sent me two specimens from Nasratabad on the 7th idem.

65. THE REDSHANK. (1464) *Totanus calidris.*

Obtainable in Seistan ; but I never obtained a single specimen. "It is very wary and may be recognised by its loud call and by the white on its wings" (Blanford).

66. THE WOODCOCK. (1482). *Scolopax rusticula.*

One or two birds only have been seen in Seistan by members of this Mission. According to the late Sir Oliver St. John, "Rose gardens are the favourite haunts of the Woodcock in Persia."

67. THE COMMON SNIPE, FULL OR FANTAIL SNIPE.
(1484) *Gallinago cœlestis.*

Numerous in Seistan from September to end of April, when they are to be seen settling with *G. stenura* in large flocks in amongst the dense reeds of the Naizars, where they are very difficult to get at. They afford very poor sport in consequence. The largest bag obtained on the Mission was 18½ couples on 6th January 1905.

68. THE PINTAIL SNIPE. (1485) *Gallinago stenura.*

The remarks under *G. cœlestis* apply to this species also, as they are always found together during the winter.

69. THE JACK SNIPE. (1487) *Gallinago gallinula.*

Said to be moderately numerous in Seistan.

70. THE GREAT BLACK-HEADED GULL. (1489) *Larus ichthyaëtus.*

Fairly common in Seistan. A live bird was captured by some men of the Irrigation Establishment on 2nd April 1904.

71. THE SLENDER-BILLED GULL. (1493) *Larus gelastes.* (Biluch, Kothar).

On 26th April 1905. I shot two females (length of both 17·0″) near Kuhak, out of a small flock which flew overhead. No fuss, beyond a low guttural croak, was made by the others as these two fell out. Only one of them circled round once and then flew off after the remainder. No cry of distress was uttered by any one of them over their lost comrades. They had presumably not yet begun to pair off. The description of both specimens tally with that given by Blanford in Vol. IV of the "Fauna of British India," except as regards the colour of the bill, legs and feet, which are not deep red. In the case of (1) the bill is a pale livid and the legs and feet a pale orange, and in the case of (2) the bill is a very dark livid and the legs and feet orange. These specimens, however, are females, which may account for the slight difference here noticed.

72. THE CASPIAN TERN. (1498) *Hydroprogne caspia.* (Biluchi, Kothar).

Common in Seistan. On 26th April 1905 I shot one out of a couple I came across. It measured 19·25″ in length. The other beyond circling round and hovering over the body of its mate as it floated down stream, made no fuss, not even a single cry or distress, as did the mate of the Gull-billed Tern I shot on 22nd April 1905.

73. THE GULL-BILLED TERN. (1499) *Sterna anglica.* (Biluchi, Kothar.)

Common in Seistan. I noticed them flying in pairs on 22nd April 1905, when I shot one which measured 14·75″. Its mate hung about a long while expressing its genuine distress in loud cries.

74. THE BLACK-BELLIED TERN. (1504) *Sterna melanogaster.* (Biluchi, Kothar.)

I have seen only a few of this species in Seistan. They do not appear to be as common here as in India.

75. THE COMMON TERN. (1506) *Sterna fluviatilis.* (Biluchi, Kothar).

Common in Seistan. A specimen I shot at Kuhak, on the 28th April 1905, measured 13·9″ in length.

76. THE LITTLE TERN. (1510) *Sterna minuta.* (Biluchi, Kothar).

Common in Seistan. Usually seen hovering over and darting into the shallow margins of flowing streams and standing water, where little fishes congregate in large numbers. Found them flying in pairs on 5th May 1905, when I shot a specimen measuring 8·5″ in length.

77. THE EASTERN WHITE PELICAN. (1520) *Pelecanus roseus.*

A live specimen was brought to Colonel A. H. McMahon, C.S.I., C.I.E., at Nat Ali, on the 6th March 1903. I also saw two large Pelicans in the distance on the Hamun-i-Sabari, on 12th January 1905, but could not say for certain whether they belonged to this species or *P. onocratalus.*

78. THE WHITE OR ROSEATE PELICAN. (1521) *Pelecanus onocratalus.*

See foregoing.

79. THE LARGE CORMORANT. (1526) *Phalacrocorax carbo.*

On 29th October 1904 I saw two flights of Cormorants going down the Rud-i-Seistan and several more at other times, but did not secure any specimens.

80. THE LITTLE CORMORANT. (1528) *Phalacrocorax javanicus.*

See foregoing.

81. THE COMMON OR BLUE HERON. (1555) *Ardea cinerea.*

Common in Seistan. I shot two specimens, at Kuhak, on the 3rd October 1903.

82. THE LITTLE BITTERN. (1570) *Ardetta minuta.*

A specimen shot by Major T. W. Irvine, I.M.S., and now in the Indian Museum, Calcutta, belongs, I believe, to this species.

83. THE BITTERN. (1574) *Botaurus stellaris.*

A fine specimen of this Bittern was shot on the Farrah Rud in December 1904.

84. THE COMMON FLAMINGO. (1575) *Phœnicopterus roseus.*

Several flights of this Flamingo have been seen from time to time, but none so far as I know, has been shot by members of this Mission. A flock I saw on 28th April 1905 flew over the Mission Camp, Kuhak, travelling north in the direction of the Hamuns.

85. THE LESSER FLAMINGO. (1576) *Phœnicopterus minor.*

Only one specimen of this small Flamingo has been secured on this Mission. It was shot by Khan Bahadur Mir Shams Shah on the Farrah Rud in December 1904.

86. THE MUTE SWAN. (1577) *Cygnus olor.*

This Swan is undoubtedly to be found on the Hamuns of Seistan though no specimens have been secured.

87. THE WHOOPER. (1578) *Cygnus musicus.*

A fine specimen of this Swan was brought into the Mission Camp on the Farrah Rud on the 13th January 1905. It was shot by a Sayad (fowler) on the Hamun-i-Sabari, where it appears to be fairly numerous. Many of their young are said to have been caught on the Hamuns, so that this Swan may be considered a permanent resident in Seistan.

88. THE GREY LAG GOOSE. (1579) *Anser ferus.*

Common in Seistan. I obtained a specimen near the Hamun-i-Sabari on 27th December 1904, and another was sent to me from Kila-i-Nao during March 1905.

89. THE SHELDRAKE. (1587) *Tadorna cornuta.*

This is a permanent resident in Seistan and rather numerous during the winter. On 22nd April 1904 the Irrigation Camp came across a large number of very young ducklings of this species between Chah Muhammad Raza and Sehkoha, in small bushes at the foot of the high "dasht," on a dry portion of the Hamun. Near by were some low reeds, while the water of the Hamun itself was some 300 yards off. There were several full-grown Sheldrakes, each followed by a brood of some 15 or 16 ducklings. Eleven of these ducklings were captured and sent to me, and a few of them lived till they were full grown. On 24th June 1904 one of these flew away, and I was compelled to clip the wings of the remainder.

90. THE MALLARD. (1592) *Anas boscas.*

Numerous on the Hamuns, several birds having been shot by members of this Mission. Appear to arrive late in the autumn and to leave in March.

91. THE GADWALL. (1595) *Chaulelasmus streperus.*

Appear to arrive late in the autumn and to leave in March. Not common in Seistan.

92. THE COMMON TEAL. (1597) *Nettium crecca.*

A remarkably common bird in Seistan and appears to breed in the country between the 1st and 10th April 1905. Captain R. C. Bell, while out inspecting his camels, saw thousands of this species all over the country between Kuhak, Zahidan and Lutak. Every piece of water he came to was literally covered with them, and out of a bag of 50 birds shot by him, the greater number consisted of the common Teal, a small number only comprising some Red-crested Pochard, Gadwalls and Shovellers.

93. THE WIGEON. (1599) *Mareca penelope.*

Specimens were obtained during the winter by the members of the Mission.

94. THE PINTAIL. (1600) *Dafila acuta.*

Obtainable in Seistan, specimens having been obtained by members of this Mission. Appear to arrive late in autumn and to leave again in March.

95. THE SHOVELLER. (1602) *Spatula clypeata.*

Numerous on the Hamuns during the winter and is perhaps a permanent resident, breeding doubtless in the Naizars.

96. THE MARBLED DUCK. (1603) *Marmaronetta angustirostris.*

(Biluchi, Mow.)

Another common duck in Seistan, like the Common Teal. Within a radius of 4 miles round Kuhak, Major T. W. Irvine, I.M.S., and Captain R. C. Bell, between 7th and 23rd April 1904, shot no less than 80 of this species alone. It is a permanent resident and begins to breed at the end of April. I shot a pair on the 22nd April 1905 near Kuhak, and found on examination that the female would have laid in about a week's time, while on 5th May of the same year a female with nest and 16 eggs, all more or less fresh, was sent to me by Lala Thakurdass, Irrigation Supervisor, from near old Shaharistan. Ducklings were also brought to me on the following dates:—

1st June 1904	1.
14th ,, ,,	2.
6th July 1904	5, nearly full grown.
8th ,, ,,	several do.

I also shot a full-grown bird on the Rud-i-Seistan on 3rd October 1904. A pair I shot at Kuhak, on 22nd April 1905, measured—male 18·5, female 17·0.

97. THE RED-CRESTED POCHARD. (1604) *Netta rufina.*

Numerous on the Hamuns during the winter, and probably remains on and breeds, during the summer, in the Naizar.

98. THE POCHARD OR DUN-BIRD. (1605) *Nyroca ferina.*

Common during the winter, when several specimens were shot by members of this Mission. This bird also doubtless stays on and breeds in the Naizars during the summer.

99. THE WHITE-EYE DUCK. (1606) *Nyroca ferruginea.*

Common during the winter.

100. THE TUFTED DUCK. (1609) *Nyroca fuligula.*

Specimens were obtained during the winter.

101. THE GOLDEN-EYE. (1610) *Clangula glaucion.*

A rare bird in Seistan, only two specimens having been shot by members of this Mission. This was during January 1905, when the cold was unusually severe.

102. THE WHITE-HEADED OR STIFF-TAILED DUCK.
(1611) *Erismatura leucocephala.*

Very common on the Hamuns during the winter, when several specimens were shot by members of the Mission. Perhaps breeds in Seistan.

103. THE GREAT-CRESTED GREBE. (1615) *Podicipes cristatus.*

Fairly common during the winter on the Seistan Hamuns. On 4th February 1904 I saw several specimens, near Puzak, in the deep open patches of water. It is a good diver and very vary. Its upright bifid crest shows very conspicuously even at a distance.

104. THE INDIAN LITTLE GREBE, OR DABCHICK. (1617) *Podicipes albipennis.*

A young bird was brought to me at Kuhak on the 7th July 1904, so that this species is not only obtainable in Seistan but breeds here.

THE MOTHS OF INDIA.

SUPPLEMENTARY PAPER TO THE VOLUMES IN "THE FAUNA OF BRITISH INDIA."

SERIES III. PART III,

By Sir George Hampson, Bart., F.Z.S., F.E.S.

(*Continued from page* 461 *of this Volume.*)

Sub-family Agrotinæ.

Genus Feltia.

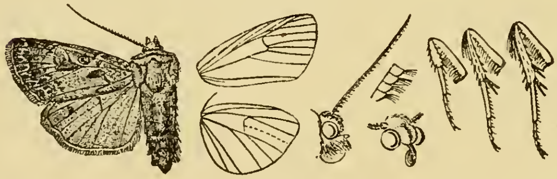
Type.

Feltia, Wlk., IX, 293 (1856)... *ducens.*

Proboscis fully developed ; palpi obliquely upturned, not reaching vertex of head, the second joint fringed with long hair in front ; frons with slight ridge-like vertical prominence ; antennæ of male serrate and fasciculate in Indian species ; tibiæ strongly spined, the mid and hind tibiæ with tufts of hair on outer side from base. Forewing rather short and broad, the apex rounded ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing, with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from just below middle of discocelulars ; 6·7 from upper angle ; male with the claspers simple, hooked.

1628*e*. Feltia duo-signa, Hmpsn., Cat. Lep. Phal. B.M., IV., p. 350, pl. 68, f. 10 (1903).

♂. Head and thorax brown, mixed with grey ; palpi blackish at sides, except at tips ; tegulæ with black medial line ; tarsi tinged with white; abdomen grey-brown. Forewing fuscous brown, strongly irrorated with grey ; a double waved, subbasal line from costa to submedian fold ; a waved black antemedial line angled outwards below costa and strongly above inner margin, defined by whitish on inner side ; claviform elongate, black, or with slight greyish centre ; orbicular and reniform fuscous defined by black, the former round, elliptical, or produced to a point on outer side, the latter large, strongly angled inwards on median nervure, and sometimes connected with the former ; the postmedial line dentate, black defined by whitish on outer side, bent outwards below costa, excurved to vein 4, then oblique, and incurved in submedian fold ; the subterminal line whitish, angled outwards at vein 7 and dentate on veins 4·3, with a series of dentate black marks before its medial part ; a terminal series of black points ; cilia with pale line at base. Hindwing white, tinged with brown on costal and terminal areas ; the veins brown ; a brown terminal line and lines through the cilia ; the underside with the costal area brown, irrorated with white, a dark discoidal spot and traces of curved postmedial line.



Feltia duo-signa ♂ $\frac{1}{1}$

♀. Hindwing wholly suffused with brown.

Habitat.—Kashmir, Scinde Valley, Goorais Valley. *Exp.* 36 mill.

Genus Hermonassa.

A. Hindwing uniform brown .... *sinuata.*
B. Hindwing pale, at least towards base.
  a. Forewing with pale streaks on the veins............... *spilota.*
  b. Forewing without pale streaks on the veins.
    a Forewing with the ground colour olive-green or suffused in part with olive. *Exp.* 34—38 mill.
      a^2 Forewing with the antemedial line bisecting the claviform .... *incisa.*
      b^2 Forewing with the antemedial line not bisecting the claviform..................... .... *lanceola.*
    b^1 Forewing fuscous suffused with purple or rufous, rarely with olive. *Exp.* 32 mill........................ *consignata.*

1676. Hermonassa sinuata.

1672. Hermonassa spilota.

1673. Hermonassa incisa.

Subsp. 1, much darker ; thorax largely mixed with black ; forewing fuscous, the basal area, and the costal area to beyond middle, suffused with olive green ; hindwing tinged with fuscous.

Habitat.—Kashmir, Rala, Barra Larcha ; Punjab, Thundiani ; Dalhousie; Dharmsala ; Tibet, Yatung.

1675. Hermonassa lanceola.

1671. Hermonassa consignata, insert (syn.) *Hermonassa chalybeata,* Moore, P.Z.S., 1881, p. 353, pl. 38, f. 17 ; Hmpsn., Moths. Ind., II., p. 197.

The typical form has the forewing red-brown, irrorated with blue-grey and with a slight olive tinge.

ab^1. Forewing more ferruginous red, without blue-grey irroration, some black suffusion in cell before and between the stigmata.

ab^2. Paler ; head and thorax and basal half of forewing pale olive greenish ; abdomen and hindwing whitish, the former with the anal tuft rufous.

ab^3. *lunata,* tegulæ black, or with black line at base ; forewing brown suffused with purple, and without blue-grey irroration ; claviform often minute or absent, orbicular more triangular. Kuku-noor, Kashmir, Thundiani.

ab^4. *chalybeata,* smaller ; forewing fuscous, irrorated with blue-grey, the markings less distinct, claviform minute or absent. Yatung.

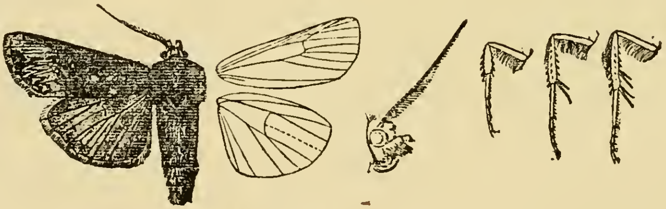
Genus Agrotis.

Agrotis, Ochs. Schmett. Eur., IV., p. 66 (1816), non. descr., Treit. Schmett. Eur., V (1), p. 125 (1825)............. . ... *rectangula.*
Graphiphora, Ochs. Schmett. Eur., IV., p. 68 (1816), non descr. .... *ravida.*

Caradrina, Ochs. Schmett. Eur., IV., p. 80 (1816), non. descr.; Treit. Schmett. Eur., V. (1), p. 246 (1825)	*glareosa.*
Noctua, Treit. Schmett. Eur., V., p. 206 (1825), nec. Linn...	*ravida.*
Diarsia, Hübn. Verz., p. 222 (1827)	*dahli.*
Megasema, Hübn. Verz., p. 222 (1827)	*triangulum.*
Ochropleura, Hübn. Verz., p. 223 (1827)........................	*musiva.*
Eugraphe, Hübn. Verz., p. 224 (1827)............................	*signa.*
Ogygia, Hübn. Verz., p. 224 (1827)	*flammatra.*
Chersotis, Boisd. Ind. Meth., p. 103 (1840)	*rectagula.*
Spælotis, Boisd. Ind. Meth., p. 106 (1840)	*augur.*
Dichargyris, Led. Noct. Eur., p. 206 (1867)	*melanura.*

Proboscis fully developed; palpi obliquely upturned, the second joint broadly scaled in front, the third with small tuft of hair; eyes smooth, large, round; frons smooth; antennæ of male typically ciliated; head and thorax clothed with hair and scales and with crests on vertex of head and pro-and metathorax; fore tibiæ finely spined at sides; mid and hind tibiæ spined; abdomen dorsally rather flattened, clothed with rough hair towards base, and with lateral tufts towards extremity. Forewing rather narrow, the apex rectangular; veins 3 and 5 from close to angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base.

Sect. I. Antennæ of male bipectinate with short branches, the apical part ciliated.



Agrotis ypsilon ♂ $\frac{1}{1}$.

1623. Agrotis ypsilon, insert (syns.) *Noctua robusta*, Blanch. Gay's Chile, p. 75, pl. 6, f. 9 (1852).

Agrotis bipars, Wlk. X., 334 (1856); *Agrotis frivola*, Wllgrn. Wien. Ent. Mon., IV., p. 160 (1860).

Agrotis aureolum, Schaus, J. N. Y. Ent. Soc., VI., p. 107 (1898).

Section II. Antennæ of male ciliated.

A. (*Diarsia*) Palpi with the hair on 2nd joint produced to a point at extremity.

a. Hindwing orange.

*a*¹. Hindwing with blackish discoidal lunule	*orbona.*
*b*¹. Hindwing without blackish discoidal lunule......	*pronuba.*

b. Hindwing not orange.

a^1. Tegulæ pale at base, with prominent black patch at tips.

a^2. Forewing with the orbicular V-shaped open above.

a^3. Forewing with prominent pale costal fascia from base to postmedial line, with fine streaks on it defining the veins .... *stentsi.*

b^3. Forewing without prominent pale costal fascia.

a^4. Forewing with black bar from costa before subterminal line .... *c. nigrum.*

b^4. Forewing without black bar from costa before subterminal line .. .. *deraiota.*

b^2. Forewing with the orbicular elliptical or round .... *flammatra.*

b^1. Tegulæ concolorous or with narrow dark terminal band.

a^2. Forewing with distinct black bar or spots on costal area before subterminal line.

a^3. Forewing with the costal area reddish or ochreous to the postmedial line.

a^4. Forewing with the antemedial line angled inwards on vein 1.................... .... *renalis.*

b^4. Forewing with the antemedial line not angled inwards on vein 1 .. .. *consanguinea.*

b^3. Forewing with the costal area concolorous.

a^4. Forewing with the antemedial line outwardly oblique from below costa to vein 1 .... *triangulum.*

b^4. Forewing with the antemedial line inwardly oblique from below costa to vein 1... *junctura.*

b^2. Forewing without black bar or spots before subterminal line.

a^3. Forewing with the costal area whitish to the postmedial line .... *plecta.*

b^3. Forewing with the costal area concolorous.

a^4. Forewing with black bars from costa at subbasal and antemedial lines .... *albipennis.*

b^4. Forewing without black bars from costa at subbasal and antemedial lines.

a^5. Forewing without black patch below the cell beyond subbasal line.

a^6. Forewing with the antemedial line oblique, slightly waved.

- a^{7}. Forewing with medial shade.
  - a^{8}. Forewing with the inner area concolorous.
    - a^{9}. Hindwing whitish towards base. *mandarinella.*
    - b^{9}. Hindwing uniform fuscous brown.
      - a^{10}. Forewing without olive-yellow shade from costa beyond middle.
        - a^{11}. Forewing with the ground-colour grey.. *niveisparsa.*
        - b^{2}. Forewing suffused with rufous or purplish ... *dahli.*
      - b^{10}. Forewing with olive-yellow shade on costal area from middle to subterminal line including the reniform..................... *rubecilia.*
  - b^{8}. Forewing with the inner area suffused with blackish .... *basistriga.*
- b^{7}. Forewing without medial shade.
  - a^{8}. Forewing with the veins not streaked with grey.
    - a^{9}. Forewing not suffused with purple .... *flavirena.*
    - b^{9}. Forewing suffused with purple.
      - a^{10}. Forewing with white annuli to the stigmata .. *tincta.*
      - b^{10}. Forewing without white annuli to the stigmata ... *cerastioides.*
  - b^{8}. Forewing with the veins streaked with grey .... *griseirena.*
- b^{6}. Forewing with the antemedial line excurved from costa to median nervure, then incurved .... *cervina.*
- b^{5}. Forewing with black patch below the cell beyond subbasal line .... *poliogramma.*

1653*a*. AGROTIS ORBONA, Hüfn. Berl. Mag. iii, p. 304 (1767).

Noctua subsequa, Schiff. Wien. Verz. p. 79 (1776); Hübn. Eur. Schmett. Noct., f. 106.

„ *consequa*, Hübn. Eur. Schmett. Noct., f. 105 (1827).

Agrotis sarmata, Ramb. Ann. Soc. Ent Fr., 1871, p. 315.

Head and thorax pale rufous to grey tinged with rufous; abdomen pale-brown, the anal tuft and ventral surface tinged with rufous. Forewing pale rufous to grey, tinged with olive or dark-brown or irrorated with black; an indistinct, double, curved subbasal line from costa to submedian fold, with more prominent striga at costa; a similar antemedial line extending to inner margin; orbicular and reniform with pale outlines, the former round or oblique and open above; the postmedial line indistinct, double, waved, with more prominent striæ at costa, oblique to vein 4 and slightly incurved at discal fold, incurved below vein 4; the subterminal line indistinct, double, grey, slightly defined by dark suffusion on inner side and by a prominent double dentate black mark below costa, angled outwards at vein 7 and excurved at middle; a terminal series of black points. Hindwing orange; some brownish suffusion at base; a black discoidal lunule; a subterminal black band with waved edges, broad towards costa, narrowing towards tornus; the underside with the costal area red suffused with white.

ab. 1 *consequa*. Forewing darker.

Habitat.—EUROPE; ARMENIA; ASIA MINOR; SYRIA; W. TURKISTAN; KASHMIR, Dana; PUNJAB, Sultanpur. *Exp.* 40-46 mill.

Larva. Greyish ochreous or fuscous; dorsal line broad, ochreous yellow, with fine black edges; a subdorsal series of dark fuscous oblong marks with a yellowish-grey line below them; lateral line pale; subspiracular line broad, pale ochreous with dark edges; head pale fuscous with dark markings. Food plants, grasses, *Ranunculus*, *Primula*, etc.

1653. AGROTIS PRONUBA.

1651. AGROTIS STENTSI, Led. Verh. Zool-bot Ges. Wien. 1853, p. 367, pl. 4, f. 4.
Ochropleura triangularis, Moore, P.Z.S., 1867, p. 55

Habitat.—SIBERIA; TURKISTAN; TIBET; AMURLAND; JAPAN; KASHMIR; PUNJAB; SIKHIM.

1747. AGROTIS C-NIGRUM.

1651*a*. AGROTIS DERAIOTA.
Amathes c-nigrum, Hmpsn. Ill. Het. B. M., ix., p. 94, pl. 176, f. 4 (Larva), nec Linn.

1650. AGROTIS FLAMMATRA, insert (syns) *Agrotis deleta*, Koll. Ins. Pers., p. 53 (1848); *Agrotis bimaculata*, Mill. Cat. Rais. 2, Suppl., p. 15 (1875).

1648*a*. AGROTIS RENALIS, Moore, P.Z.S., 1867, p. 55.
Ochropleura subpurpurea, Leech. Trans. Ent. Soc. 1900, p. 35.

Head and thorax dark-brown mixed with rufous and the scales tipped with blue-grey; the tegulæ sometimes olive-ochreous except at tips; the metathorax with rufous crest; abdomen fuscous brown, the anal tuft tipped with ochreous. Forewing dark-brown suffused with purple-grey; the costal area ochreous or rufous to the postmedial line; a double subbasal line from costa to submedian fold, in which there is a short black streak; the antemedial line double, waved, excurved above inner margin and with oblique black streak before it in cell; claviform with its extremity slightly defined by black; orbicular and reniform defined by black, the former rounded or diamond-shaped, open above, the cell before and between the stigmata suffused with black; the postmedial line indistinct, double, minutely dentate, and produced to points on the veins, bent outward, below costa, excurved to vein 4, then incurved; the subterminal line indistinct, defined on inner side by an oblique black bar from costa, angled outwards at vein 7 and excurved at middle; a terminal series of black points. Hindwing dark fuscous brown, with fine ochreous line at base of cilia; the underside irrorated with grey.

Habitat.—W. CHINA, Omei-shán, Wa-ssu-kou; PUNJAB, Simla, Dalhousie. *Exp.* 52-60 mill.

1648. AGROTIS CONSANGUINEA, Moore, P.Z.S., 1881, p. 353.

Head and thorax dark brown mixed with reddish brown, some of the scales tipped with grey; tegulæ sometimes ochreous except at tips; abdomen grey brown, the anal tuft tinged with ochreous. Forewing dark brown with a greyish gloss; the costal area ochreous or tinged with rufous to the postmedial line; the sub-basal line represented by a black point below costa and a curved line between cell and vein 1, followed by a blackish patch with black point above it in cell; the antemedial line double, oblique, minutely waved; claviform with its extremity defined by black; orbicular and reniform defined by black and their centres by brown, the former round, or somewhat oblique elliptical, the latter with some rufous on its upper part, the cell before and between them black; the postmedial line double, dentate and produced to points on the veins slightly bent outwards below costa, excurved to vein 4, then incurved; the subterminal line defined on inner side by an oblique black bar from costa slightly angled outwards at vein 7 and excurved at middle. Hindwing pale fuscous brown; the cilia grey with a brown line through them; the underside pale, the costal area thickly irrorated with fuscous, the terminal area suffused with fuscous.

Habitat.—KASHMIR, Dras, Scinde Valley; PUNJAB, Simla, Dalhousie, Thundiani, Murree, Dharmsála; TIBET, Yatung. *Exp.* 42-50 mill.

1648*b*. AGROTIS TRIANGULUM, Hüfn. Berl. Mag. III., p. 306 (1776).

Noctua sigma. Esp. Schmett. IV., pl. 186, ff. 1·3 (1796); Hübn. Samml Eur. Schmett. Noct. f. 497.

Head and tegulæ except tips brownish white; palpi blackish at sides except at tips; extremities of tegulæ and thorax red-brown; tarsi fuscous with pale rings; abdomen ochreous irrorated with dark brown, the anal tuft and ventral surface rufous. Forewing pale greyish brown suffused with red-brown; the sub-basal line pale, with black spots on its inner side below costa and cell, a black patch beyond it below the cell with a point in cell above its extremity; the antemedial line double, the outer blackish and strong from costa to submedian fold, slightly angled outwards below costa, then oblique and slightly incurved to above inner margin, where it is angled outwards; claviform with its upper edge defined by black; orbicular and reniform with greyish annuli defined by black, the former oblique v-shaped, open above, the latter constricted at middle, the cell before and between them black-brown; the postmedial line double, minutely dentate and produced to points on the veins and with black striga on its inner edge at costa, bent outwards below costa, excurved to vein 4, then oblique ; the subterminal line greyish, slightly defined by brown on inner side and by an oblique black bar from costa, angled outward at vein 7 and excurved at middle ; a terminal series of dark points. Hindwing brown ; the cilia ochreous ; the underside pale irrorated with brown, a small dark discoidal spot and curved postmedial line.

Habitat.—EUROPE ; ARMENIA ; KASHMIR. *Exp.* 36-48 mill.

Larva. Ochreous or brown speckled with black ; dorsal line pale ; a subdorsal series of oblique dark marks on somites 4-11, darker and confluent on 11 and followed by a pale bar ; subspiracular line pale ochreous ; head pale brown with blackish markings. Food plants *Rumex, Stellaria, Salix,* etc.

1649. AGROTIS JUNCTURA.

1631. AGROTIS PLECTA insert (syns.) *Agrotis unimacula.* Staud. Stett. Ent. Zeit, 1859, p. 21.

Agrotis anderssoni, Lampa, Tidskr 1885, p. 54 ; *Agrotis glaucimacula* Græs. Berl. Ent. Zeit. 1888, p. 321.

1639. AGROTIS ALBIPENNIS.

1639*a*. AGROTIS MANDARINELLA, Hmpsn. Cat. Lep. Phal. VI. B. M. p. 418, pl. 70, f. 25.

Graphiphora mandarina, Leech. Trans. Ent. Soc 1900, p. 42 (nec p. 36).

Head and thorax bright rufous slightly mixed with grey ; palpi rufous and blackish, pale at tips ; tibiæ and tarsi blackish mixed with white ; abdomen grey-brown, the anal tuft and ventral surface reddish ochreous. Forewing bright rufous suffused with purplish ; a double black sub-basal line from costa to submedian fold, excurved below costa and with a point beyond it in cell ; a double waved antemedial line, angled outwards below costa and more strongly above inner margin ; claviform small, slightly defined by ochreous and brown ; orbicular and reniform with rufous centres and ochreous annuli defined by rufous, the former small, round ; the postmedial line dentate and produced to points on the veins, bent outwards below costa, excurved to vein 4, then incurved ; the subterminal line pale, defined on inner side towards costa by a dark shade with pale points on it, slightly angled outwards at vein 7 and excurved at middle ; a terminal series of black points. Hindwing pale fuscous brown ; the cilia pale purplish red, the costal area irrorated with black, a small discoidal lunule and sinuous postmedial line.

Habitat.—W. CHINA, Pu-tsu-fang, Nitou ; TIBET, Yatung. *Exp.* 36 mill.

1643. AGROTIS NIVEISPARSA.

1635. AGROTIS DAHLI, Hübn. Eur. Schmett. Noct. ff. 465, 466 (1827).

,, *descripta,* Hmpsn. Moths. Ind. ii. p. 184. (nec Brem.)

Graphiphora canescens, Butl. Ill. Het. B. M. ii. p. 28. pl. 30, f. 1 (1878).

Orthosia erubescens, Butl. A. M. N. H. (5) v. p. 224 (1880).

Cerastis subdolens, Butl. Trans. Ent. Soc. 1881 p. 181 (♂).

Chera efflorescens, Hmpsn. Ill. Het. B. M. viii, p. 78, pl. 145, f. 7 (1891).

Chera erubescens, Hmpsn. Ill. Het. B. M. viii, p. 78., pl. 145, f. 14. (1891).

1635*a*. AGROTIS RUBICILIA, Moore, P.Z.S., 1867, p. 55.

Graphiphora nigrosigna, Moore, P.Z.S., 1881, p. 352 pl. 38. f. 4.

Head and thorax olive-yellow and rufous to bright rufous, ; palpi except at tips and hair on pectus purplish red, tibiæ and tarsi blackish ; abdomen greyish or ochreous, the anal tuft and ventral surface rufous. Forewing pale rufous suffused with yellow except the terminal area from apex to middle of inner margin, or purplish with some olive suffusion from middle of costa to subterminal line and extending to lower angle of cell ; an indistinct, waved, double sub-basal line from costal to submedian fold ; a double, waved antemedial line ; claviform represented by a fuscous point at its extremity ; orbicular and reniform indistinctly defined by brown, the former round ; an indistinct waved medial line, angled outwards to lower angle of cell ; the postmedial line double, dentate and produced to points on the veins, bent outwards below costa, slightly incurved at discal fold and incurved below vein 4 ; the subterminal line greyish, angled outwards at vein 7 and excurved at middle ; a terminal series of points. Hindwing fuscous brown ; the cilia purplish red ; the underside pale reddish, the costal area deeper red, and the costal and terminal areas irrorated with brown, a slight discoidal spot and sinuous postmedial line.

Habitat.—JAPAN ; W. CHINA ; KASHMIR, Narkundah ; PUNJAB, Sultanpur, Dalhousie, Dharmsála ; SIKHIM. *Exp.* 32-40 mill.

1635*b*. AGROTIS BASISTRIGA, Moore, P.Z.S., 1867, p. 54 ; Hmpsn. Cat. Lep. Phal. B.M. IV., p. 427, pl. 71 f. 4.

Head and thorax purplish grey suffused with deep red-brown, or entirely red-brown ; palpi deep red-brown, pale at tips ; tibiæ and tarsi blackish irrorated with white ; abdomen pale red-brown, the anal tuft and ventral surface purplish red. Forewing deep rufous and olive fuscous, more or less completely suffused with purple-grey, some dark suffusion above basal part of vein 1 and on medial part of inner margin ; a double waved sub-basal line from costa to vein 1 with a dark point in the cell beyond it ; a double, waved, antemedial line strongly angled outwards above inner margin ; claviform small, defined by brown ; orbicular and reniform defined by brown, and with their centres defined by brown ; an indistinct waved medial line angled outwards on median nervure ; a double postmedial line, dentate and produced to points on the veins, bent outwards below costa, slightly angled inwards at discal fold, incurved below vein 4 ; a double subterminal line, angled outwards at vein 7 and excurved at middle, and with some olive-brown suffusion before it at costa, some pale points on costa towards apex ; a terminal series of dark points. Hindwing yellowish white, the terminal area suffused with fuscous or fuscous brown ; cilia pale purplish red ; the underside paler, the costal area suffused with purplish red ; a dark discoidal lunule and sinuous postmedial line.

Habitat.—W. CHINA ; PUNJAB, Dharmsála ; TIBET, Yatung ; SIKHIM. *Exp.* 38—42 mill.

1635*c*. Agrotis flavirena, Moore ; P.Z.S., 1881, p. 352, pl. 38, f. 4.
Graphiphora vulpina, Moore, Lep. Atk., p. 118 (1882).

♀. Head and tegulæ red-brown, the latter with dark patches irrorated with white ; thorax purple-brown, the scales tipped with white ; pectus, legs, and abdomen grey-brown. Forewing red-brown with slight white irroration at base, below costa, and on the veins ; subbasal line obsolete ; antemedial line indistinct, waved ; claviform represented by a dark point at its extremity ; orbicular indistinctly defined by brown, round ; reniform ochreous whitish defined by brown ; postmedial line indistinct, minutely waved, bent outwards below costa, excurved to vein 4, then oblique ; traces of some subterminal points ; a fine pale line at base of cilia. Hindwing fuscous brown, the cilia pale purplish ; the underside pale, the costal area and termen tinged with pink, a dark discoidal lunule and indistinct curved postmedial line.

Hab.—Sikhim. *Exp.* 46 mill.

1635*d*. Agrotis tincta, Leech, Trans. Ent. Soc., 1900, p. 41, Hmpsn Cat. Lep. Phal. B. M. IV., p. 429, pl. 71, f. 7.

♀. Head and thorax purple brown ; palpi deep red-brown, pale at tips ; frons and shoulders suffused with grey ; tibiæ and tarsi fuscous, the spurs with pale rings ; abdomen fuscous-brown, the dorsal tuft and ventral surface rufous. Forewing red-brown suffused with purplish grey, except the end of cell and area from it to costa at subtermedial line ; faint traces of a subbasal line ; an indistinct double antemedial line filled in with grey, angled outwards below costa, on median nervure, and on vein 1, and inwards in cell and submedian fold ; claviform with its extremity slightly defined by rufous ; orbicular and reniform irrorated with grey and with grey annuli slightly defined by blackish, the former rounded, its lower extremity produced to a point, sometimes connected with the reniform ; the postmedial line very indistinct, double, even bent outwards below costa, excurved to vein 4, then incurved, bent outwards to inner margin; the subterminal line indistinct, greyish, slightly defined by rufous on inner side, angled outwards at vein 7, and excurved at middle ; traces of a terminal series of black points. Hindwing fuscous-brown ; the cilia purplish-red ; the underside pale purplish-red, the costal area irrorated with fuscous-brown, a small discoidal spot and sinuous postmedial line.

Hab.—W. China, Omei Shan ; Punjab, Simla. *Exp.* 36-40, mill.

1636. Agrotis cerastioides.

1644. Agrotis griseivena.

1638. Agrotis cervina.

1638*a*. Agrotis poliogramma, Hmpsn., Cat. Lep. Phal., B. M. IV., p. 438, pl. 71, f. 16 (1903).

♀. Head and thorax black-brown, mixed with grey and pale brown ; tegulæ with black medial line and black at tips ; tarsi tinged with white ; abdomen ochreous mixed with dark brown. Forewing dark brown, irrorated with grey, thickly on basal and terminal areas ; the veins streaked with grey ; the subbasal line represented by black striæ from costa and median nervure, defined by grey on outer side and with black patch beyond it below the cell; the antemedial line angled outwards below costa, oblique to vein 1, then strongly angled outwards above inner margin, defined by grey on inner side; claviform defined by black; acute at extremity, and with an oblique ochreous white fascia from it to postmedial line; orbicular and reniform with grey annuli, defined by black, their centres irrorated with grey, the former oblique, open above, the latter angled inwards on median nervure; the postmedial line defined by grey on outer side, minutely dentate, bent outwards below costa, very slightly angled inwards in discal fold and oblique below vein 4; the subterminal line grey, defined by a series of dentate black marks on inner side, slightly angled outwards at vein 7 and excurved at middle; a terminal series of small black lunules; cilia intersected with grey. Hindwing fuscous brown, with fine dark terminal line; the cilia whitish with brown line at base; the underside grey, thickly irrorated with dark brown, a sinuous postmedial line.

Hab.—KASHMIR; Barra Larcha, Goorais Valley. *Exp.* 36 mill.

B (*Agrotis*) Palpi with the 2nd joint evenly fringed with hair in front.
  a. Hindwing white, the termen tinged with fuscous.
    a^1 Forewing with black fascia in cell between the stigmata.
      a^2 Forewing with the antemedial line dentate towards costa .... *dispilata.*
      b^2 Forewing with the antemedial line waved towards costa .... *sicca.*
    b^1 Forewing without black fascia in cell between the stigmata.................................. *putris.*
  b. Hindwing white at base, the terminal half suffused with fuscous .... *ravida.*

1642. AGROTIS DISPILATA.

1641. AGROTIS SICCA, Guen. Noct. i., p. 135 (1852). Hmpsn., Cat. Lep Phal. B. M. IV., p. 451, pl. 71, f. 30.

Axylia renalis, Moore. P. Z. S., 1881, p. 341.

1640. AGROTIS PUTRIS, insert (Syn.) *Noctua subcorticalis*, Hüfn. Berl. Mag. iii, p. 308 (1767).

1645. AGROTIS RAVIDA, insert (Syn.) *Agrotis nipona*, Feld. Reis. Nov., pl. 110, f. 20 (1874).

Graphiphora caliginea, Butl., A. M. N. H. (5) i, p. 165 (1878), and *Agrotis glis*, Christ. Rom. Mem. iii, p 64, pl. 3., f. 10 (1887).

Genus EPISILIA.

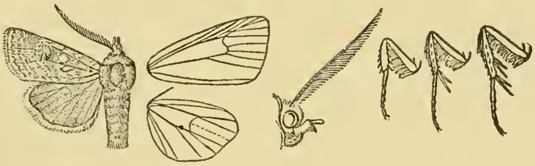
	Type.
Episilia, Hübn., Verz., p. 210 (1827)	*luteus.*
Pachobia, Guen. Noct. i., p. 341 (1852)	*tecta.*
Cyrebia, Guen Noct. ii., p. 195 (1852)	*luperinoides.*
Psaphara, Wlk. xi., 607 (1857)	*interclusa.*
Ocira, Wlk. xxxii., 656 (1865)	*ochracea.*
Choephora, Grote. Trans Am. Ent. Soc. ii., p. 199 (1868)...	*fungorum.*
Raddea, Alph. Hor. Ent. Soc. Ross. xxvi., p. 459 (1892)....	*digna.*
Ammagrotis, Staud. Iris. viii., p. 358 (1895)	*suavis.*

Proboscis fully developed; palpi obliquely upturned, clothed with long hair; frons smooth; head and thorax clothed with long hair; fore tibiæ spined at sides; mid and hind tibiæ spined Forewing with veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6 7 from upper angle.

Sect. I., *Oxira.* Antennæ of male bipectionate with moderate branches, the apical part serrate.

A. Forewing with the cell black between the stigmata.
  a Forewing with large black patch beyond the cell... *postfusca.*
  b. Forewing without black patch beyond the cell...... *ochracea ab. ruptistriga.*
B. Forewing with the cell not black between the stigmata.
  a. Forewing with distinct pale subterminal line...... .. *ochracea.*
  b. Forewing with the subterminal line indistinct, dark *olivascens.*

1627*a*. EPISILIA POSTFUSCA.



Episilia ochracea. ♂ 1. ♂

1624. EPISILIA OCHRACEA, insert (Syn.) *Mythimna deparca*, Butl. A. M. N. H. (5) vi., p. 358 (1879).

Agrotis stictica, Pouj. Bull. Soc. Ent. Fr. (6) vii., p. lxviii (1887).

1625. EPISILIA OLIVASCENS.

Sect. II. (*Pachnobia*). Antennæ of male serrate and fasciculate.

A. Forewing with the costal area pale to postmedial line....... *retracta.*
B. Forewing with the costal area concolorous ....
  a. Forewing with the cell dark rufous......... .... *tenuis.*
  b. Forewing with the cell concolorous......................... ... *homochroma.*

1634*a*.—EPISILIA RETRACTA, Hmpsn. Cat. Lep. Phal. B. M. IV; p. 489, pl. 73, f. 7 (1903).

♂. Head and tegulæ rufous, the latter with some grey near base and grey tips; thorax olive-brown; pectus, legs, and abdomen rufous. Forewing dark olive-brown, thickly irrorated with blue-grey; the costal area pale rufous irrorated with grey; the cell black-brown; traces of an antemedial line from submedian fold to inner margin; claviform a narrow pale rufous streak; orbicular and reniform pale rufous defined by whitish and confluent with costal area, the former very narrow and oblique, the latter narrow and angled inwards on median nervure to middle of cell; the postmedial line double, minutely waved, filled in with grey, bent outwards below costa to long beyond cell, excurved to vein 4, then incurved; a curved dark subterminal line; cilia brown.

Hindwing brown, tinged with fuscous on costal and terminal areas; cilia pale brown.

Habitat.—SIKHIM. *Exp.* 30 mill.

1634. EPISILIA TENUIS.

1634 b.—EPISILIA HOMOCHROMA, Hmpsn. Cat. .Lep. Phal. B.M. IV., p. 493, pl. 73, f. 14 (1903).

♂. Head and thorax deep rufous; antennæ whitish; abdomen fuscous, the ventral surface dark brown. Forewing deep chocolate-red suffused with silvery blue; an indistinct double, curved, sub-basal line from costa to submedian fold; an indistinct double, waved, antemedial line, oblique from costa to above inner margin where it is angled outwards; orbicular and reniform with silvery blue annuli defined by brown, the former oblique elliptical, open above; the postmedial line double, minutely waved, bent outwards below costa, slightly incurved at discal fold, incurved below vein 4; cilia purplish red. Hindwing ochreous white more or less suffused with fuscous brown; cilia purplish red; the underside suffused with purplish red and irrorated with fuscous, a small discoidal spot and postmedial line slightly angled at vein 6.

Habitat.—TIBET, Yatung. *Exp.* 30—34 mill.

Sect. III. (*Episilia*). Antennæ of male ciliated.

A. Forewing rufous .... *isochroma.*
B. Forewing brownish grey .... *monogramma.*

1634*c*. EPISILIA ISOCHROMA, Hmpsn. Cat. Lep. Phal. B. M. IV., p. 502, pl. 73, f. 20 (1903).

Head and thorax rufous; abdomen greyish ochreous, the anal tuft and ventral surface rufous. Forewing ferruginous red, with a few silvery-blue scales on inner and terminal areas; obicular represented by an obscure dark point, the reniform by a slight lunule; faint traces of a postmedial line bent outwards below costa, incurved at discal fold and below vein 4; traces of a subterminal line angled outwards at vein 7 and excurved at middle. Hindwing ochreous white; the costal area slightly tinged with fuscous and the terminal area in female; cilia pale rufous; the underside with slight discoidal point and traces of postmedial line.

Habitat—TIBET, Yatung. *Exp.* ♂ 28, ♀ 30 mill.

1634*d*. EPISILIA MONOGRAMMA, Hmpsn. Cat. Lep. Phal. B. M. IV., p. 509, pl. 73, f. 27 (1903).

Head and thorax grey pencilled with brown, sometimes suffused with fuscous; abdomen brownish grey. Forewing brownish grey, thickly irrorated with black; a waved sub-basal line from costa to submedian fold; an oblique waved antemedial line; orbicular and reniform greyish, with pale annuli defined by blackish, the former elliptical; a waved diffused medial shade, angled outward to lower angle of cell; the postmedial line strongly dentate, bent outwards below costa, excurved to vein 4, then incurved; an indistinct dentate subterminal line angled outwards at vein 7 and excurved at middle; a terminal series of black points. Hindwing grey suffused with fuscous brown; cilia whitish, sometimes with a brown line through them; the underside whitish, the costal area irrorated with brown, a dark discoidal spot and diffused curved postmedial line.

Habitat.—KASHMIR, Kuijar, Barra Larcha. *Exp.* 34—42 mill.

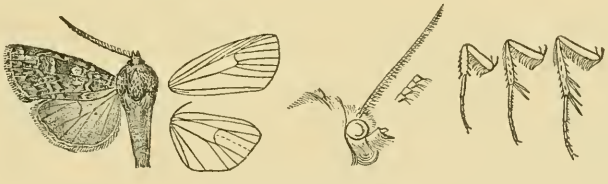
Genus LYCOPHOTIA.

	Type.
Lycophotia, Hübn. Verz., p. 215 (1827)	*porphyria.*
Hapalia, Hübn. Verz., p. 220 (1827)	*præcox.*
Peridroma, Hübn. Verz., p. 227 (1827)	*margaritosa.*
Scotophila, Steph. Ill., Brit. Ent. Haust III, p. 18 (1829) ...	*porphyria.*
Actebia, Steph. Ill. Brit. Ent. Haust, III, p. 20 (1829)	*præcox.*
Ilarus, Boisd. Ind. Moth., p. 76 (1829)	*porphyria.*
Neuria, Guen. Ann. Soc. Ent. Fr. X., p. 241 (1841) non descr.	*elegans.*
Phlebosis, Christ. Stett. Ent. Zeit. 1887, p. 164	*petersi.*
Setagrotis, Smith, Bull. U. S. Nat. Mus. 38, p. 59 (1894)......	*planifrons.*
Hypernœnia, Hmpsn. Moths. Ind. II, p. 194 (1894)	*denticulata.*
Praina, Schaus, J. N. Y., Ent. Soc. VI, p. 114 (1893)	*radiata.*

Proboscis fully developed; palpi upturned, the 2nd joint broadly scaled and with pointed tuft of hair at extremity, the 3rd joint somewhat porrect; frons smooth; eyes large, round; thorax typically with divided ridge-like dorsal crest; tibiæ spined; abdomen cylindrical, dorsally clothed with rough hair at base. Forewing usually narrow and elongate, the termen obliquely curved; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 shortly stalked.

Sect. I. Antennæ of male strongly serrate and fasciculate.

1629. LYCOPHOTIA SICHIMA.



Lycophotia sichima. ♂ ½.

Sect. II. Antennæ of male ciliated.

A. (*Peridroma.*) Pro-and metathorax with divided crests.

1665. LYCOPHATIA DENTICULATA.

B. (*Hapalia.*) Pro-and metathorax with slight spreading crests.

a. Hindwing white, the terminal area suffused with brown .... *conformis.*

b. Hindwing wholly tinged with brown .... *photophila.*

1632. LYCOPHOTIA CONFORMIS.

1630. LYCOPHOTIA PHOTOPHILA, Guen. Noct 1, p. 45 (1852).

Agrotis sollers, Staud. Stett. Ent. Zeit. 1877, p. 179. Christ Hor. Ent. Soc. Ross xii., pl. 6, f. 19.

Agrotis ignipeta, Oberth, Et. Ent. 1, p. 45, pl. 4, f. 4 (1876).

Spælotis undulans, Moore A. M. N. H. (5) 1, p. 233 ; id. 2nd Yarcand Mission, pl. 1, f. 10.

Agrotis obscurior, Staud. Stett. Ent. Zeit 1889. p. 27.

„ *candida*, Staud. Stett. Ent. Zeit 1889, p. 27.

„ *obumbrata*, Staud. Stett. Ent. Zeit 1889, p. 28.

Habitat.—ALGERIA ; SYRIA ; W. TURKISTAN ; E. TURKISTAN ; S. AFGHANISTAN; SCINDE, KARACHI.

Genus RICHIA. *Type.*

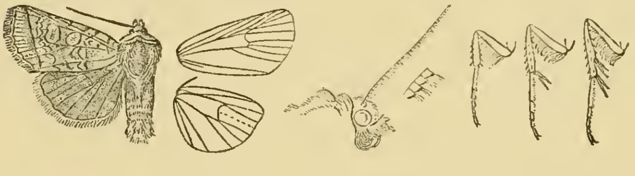
Richia. Grote, Can. Ent. xix., p. 44 (1887) .... *chortalis.*

Proboscis fully developed ; palpi oblique, the 2nd joint fringed with hair in front, the 3rd moderate ; frons smooth, eyes large, rounded, antennæ of male minutely serrate and fasciculate, head and thorax clothed with hair and scales, the prothorax with sharp ridge-like crest, the metathorax with slight crest, tibiæ strongly spined ; abdomen smoothly scaled. Forewing with veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 4 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 shortly stalked or from angle.

A. Hindwing uniformly suffused with fuscous.
  a. Forewing with the subterminal line almost straight. *curviplena.*
  b. Forewing with the subterminal line excurved below costa and at middle .... *xestiodes.*
B. Hindwing ochreous, tinged with fuscous towards termen. *fuscisignata.*

1637. RICHIA CURVIPLENA.

1637a. RICHIA XESTIODES, Hmpsn. Cat. Lep. Phal. B. M. IV ; p. 596, pl. 76, f. 14 (1903).



Richia curviplena. ♂ $\frac{1}{1}$.

Head and thorax pale rufous, the scales tipped with grey ; palpi dark rufous, paler at tips ; abdomen ochreous, dorsally tinged with fuscous, the anal tuft fulvous yellow. Forewing ochreous with a violaceous tinge and irrorated with rufous ; a rufous subbasal line from costa to submedian fold ; an oblique antemedial line, slightly incurved to costa and excurved above inner margin ; claviform defined by rufous above and at extremity ; orbicular and reniform large, defined by rufous, the former elliptical, the cell before and between them suffused with rufous ; a waved medial shade from lower angle of cell to inner margin ; a waved postmedial line excurved below costa, incurved in discal and submedian folds ; the subterminal line broadly defined by rufous on inner side and slightly on outer, excurved below costa and at middle ; a fine waved terminal line. Hindwing ochreous, suffused with fuscous; the underside ochreous, the costal and terminal areas irrorated with brown, a dark postmedial line.

Habitat.—KASHMIR, Goorais Valley. *Exp.* 38 mill.

1637b. RICHIA FUSCISIGNATA, Hmpsn. Cat. Lep. Phal. B. M. IV, p. 597, pl. 76, f. 15 (1905).

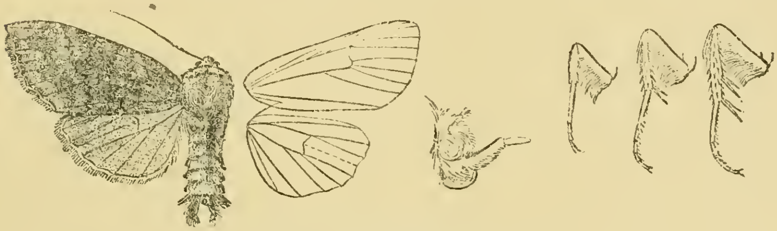
♀. Head and thorax pale rufous mixed with ochreous; palpi darker rufous except at tips; abdomen ochreous, the ventral surface tinged with rufous. Forewing pale ochreous suffused with rufous; traces of a whitish subbasal line from costa to submedian fold; an oblique whitish antemedial line with brownish line on its inner side; orbicular and reniform defined by fine whitish lines, the former oblique elliptical, the latter with blackish marks in its upper and lower extremities; postmedial line whitish, defined by a fine brown line on inner side and stronger line on outer; subterminal line whitish, defined by brown suffusion on its inner side, angled outwards at vein 7 and excurved at middle; a terminal series of small brown lunules. Hindwing and undersides ochreous yellow.

Habitat.—KASHMIR, Goorais Valley. *Exp.* 42 mill.

Genus PARAXESTIA. *Type.*

Paraxestia. Hmpsn. Cat. Lep. Phal. B. M. IV., p. 601 (1903). *flavicaudata.*

Proboscis fully developed; palpi with the 2nd joint upturned, reaching vertex of head, fringed with hair in front, and behind at base, the 3rd joint long, naked, porrect, frons smooth; eyes large, overhung by long cilia; antennæ of male ciliated; head and thorax clothed with long hair, without crests; fore tibiæ without spines; mid and hind tibiæ strongly spined; abdomen dorsally clothed with long hair at base, the claspers of male large. Forewing with the apex somewhat produced, the termen crenulate; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with the cilia crenulate; veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle.



Paraxestia flavicaudata. ♂ 1/1.

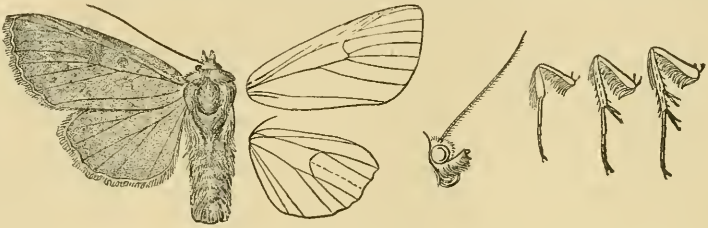
1670. PARAXESTIA FLAVICAUDATA.

Genus MYTHIMNA. *Type.*

Mythimna, Ochs. Schmett. Eur., iv., p. 70 (1816) non descr.;
Treit. Schmett. Eur., v. (1), p. 77 (1825) .... *oxalina.*
Orthosia, Ochs. Schmett. Eur., iv, p. 79 (1816) non descr.;
Treit. Schmett. Eur., v., (1) p. 230 (1825) .... *cæcimacula.*
Cerastis, Ochs. Schmett. Eur., iv., p. 84 (1816) non descr.;
Treit. Schmett. Eur., v. (2), p. 395 (1825) .... *rubricosa.*

Mesogona, Boisd. Ind. Meth., p. 144 (1840) .... *acetosellæ.*
Ammoconia, Led. Noct. Eur., p. 97 (1857)......................... *cæcimacula.*
Pseudoglæa, Grote, Can. Ent., viii., p. 18 (1876) ... . *tædata.*

Proboscis fully developed ; palpi obliquely upturned and fringed with long hair in front ; frons smooth ; eyes large, rounded ; antennæ of male typically ciliated ; head and thorax clothed with rough hair only ; fore tibiæ fringed with hair ; mid and hind tibiæ spined. Forewing with veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with the termen crenulate and slightly excised at discal fold ; veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 shortly stalked.



Mythimna indiana. ♂ $\frac{1}{1}$.

1669. MYTHIMNA INDIANA, Guen, Noct. i, p. 302 (1852).

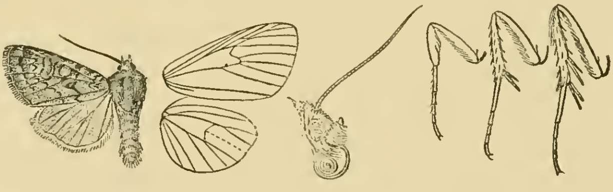
Tiracola violacea, Butl. Ill. Het. B. M., vii., p. 54., pl. 127, f. 5 (1889).

Genus TRICHEUROIS. *Type.*

Tricheurois, Hmpsn. A. M. N. H. (7), xv, p. 451 (1905) ...... *nigrocuprea.*

Proboscis fully developed ; palpi upturned, fringed with hair in front ; frons obliquely rounded ; eyes large, round, hairy ; head and thorax clothed with hair only and without distinct crests ; mid and hind tibiæ spined, abdomen with some rough hair at base. Forewing with veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 shortly stalked ; 8 anastomosing with the cell near base only.

1680. TRICHEUROIS NIGROCUPREA.



Tricheurois nigrocuprea. ♂ 1.

Genus NEUROIS. *Type.*

Neurois, Hmpsn. Cat. Lep. Phal B. M. IV., p. 610 (1903) ... *nigroviridis.*

Proboscis fully developed ; palpi upturned, not reaching vertex of head and clothed with rough hair ; frons obliquely rounded, with slight roughened prominence at extremity ; eyes large, rounded ; antennæ of male ciliated ; head and thorax clothed with scales mixed with a few hairs, the metathorax with distinct crest ; fore tibiæ fringed with hair ; mid and hind tibiæ with a few spines ; abdomen clothed with rough hair and with lateral tufts towards extremity. Forewing with veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from below angle of discocellulars ; 6·7 shortly stalked.

A. Forewing silvery white thickly irrorated with bronze green, the terminal area brown .... *nigroviridis.*
B. Forewing sap-green suffused with black and marked with pale-brown... .... *atrovirens.*
C. Forewing black-brown .... *renalba.*

1667. NEUROIS NIGROVIRIDIS.

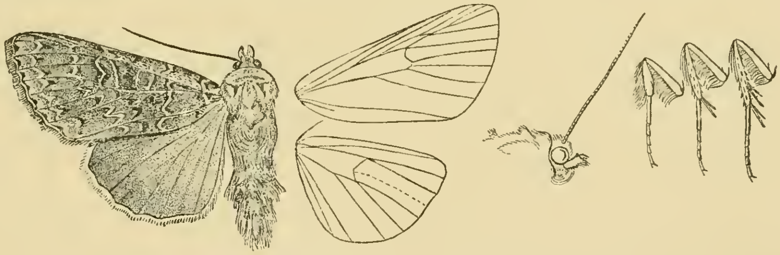
1666. NEUROIS ATROVIRENS.

1668. NEUROIS RENALBA.

Genus EUROIS

	Type.
Eurois, Hübn. Verz., p 217 (1827)	*prasina.*
Aplecta, Guen. Ann. Soc. Ent. Fr. vii., p. 217 (1845)	*prasina.*
Matuta, Grote, Can. Ent. vi., p. 116 (1874)	*tenebrifera.*
Adelphagrotis, Smith, Bull. U. S. Nat. Mus. 38, p. 38 (1890)	*stellaris.*

Proboscis fully developed ; palpi upturned, the 2nd joint broadly fringed with hair in front, the 3rd short, porrect, with some hair in front ; eyes large rounded ; frons smooth ; antennæ of male typically ciliated ; head and thorax clothed with hair and scales and with spreading crests on pro-and meta-thorax ; fore tibiæ fringed with hair ; mid and hind tibiæ spined. Forewing rather broad, the apex rectangular ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle.



Eurois virens. ♂ 1/1.

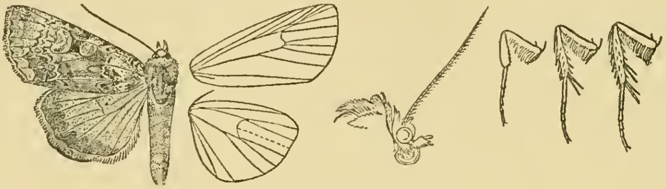
1785. EUROIS VIRENS.

Genus EPILECTA.

	Type.
Epilecta, Hübn. Verz., p. 220 (1827)	*linogrisea.*
Hiria, Dup. Cat. Meth., p. 145 (1844) nec *Hyria* Lam. Moll. 1819	*linogrisea.*

Proboscis fully developed ; palpi with the 2nd joint oblique, moderately scaled in front and with slight pointed tuft at extremity, the 3rd joint long naked and porrect ; frons smooth, with ridges of scales above and between antennæ ; eyes large, rounded ; antennæ of male ciliated ; head and thorax clothed with scales, prothorax with spreading crest, a double dorsal ridge-like crest ; mid and hind tibiæ spined ; abdomen dorsally flattened. Forewing narrow, the apex rectangular ; veins 3 and 5 from near angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from the middle of discocellulars ; 6·7 from upper angle ; 8 anastomosing with the cell near base only.

1652. EPILECTA ACCIPITER.



Epilecta accipiter. ♂ $\frac{1}{1}$.

Genus TRIPHÆNA.

	Type.
Triphæna. Hübn. Verz., p. 221 (1827) .... ·	*interjecta.*
Lampra, Hübn. Verz., p. 221 (1827)	*fimbria.*
Euschesis, Hübn. Verz., p. 221 (1827)	*janthina.*
Abagrotis, Smith, Bull. U. S. Nat. Mus. 38, p. 4 (1890)	*erratica.*

Proboscis fully developed ; palpi oblique, the 2nd joint fringed with long hair produced to a point at extremity, the 3rd joint short, porrect, and slightly fringed with hair below ; frons smooth ; eyes large, rounded ; head and thorax clothed with hair and scales, the pro-and meta-thorax with slight spreading crests ; antennæ of male typically ciliated ; tibiæ fringed with hair, the mid and hind tibiæ spined ; abdomen dorsally flattened and fringed with hair at sides. Forewing with the margins subparallel, the apex rounded ; veins 3 and 5 from close to angle of cell ; 6 from upper angle ; 9 from 10 anastomosing with 8 to form the areole ; 11 from cell. Hindwing with veins 3·4 from angle of cell ; 5 obsolescent from middle of discocellulars ; 6·7 from upper angle ; 8 anastomosing with the cell near base only.

1662. TRIPHÆNA SEMIHERBIDA.

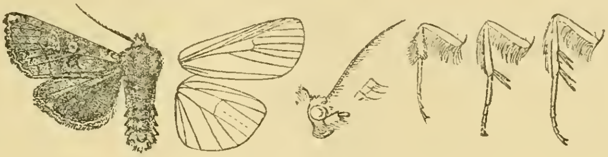
Genus PROTAGROTIS.

	Type.
Protagrotis, Hmpsn. Cat. Lep. Phal. B. M., IV, p. 655 (1903)..	*viralis.*

Proboscis fully developed ; palpi with the 2nd joint oblique and moderately fringed with hair, the 3rd porrect ; frons smooth ; eyes large, rounded ; antennæ of male with long bristles and cilia in Indian species ; head and thorax clothed with hair only and without crests ; fore tibiæ fringed with hair ; mid tibiæ without spines ; hind tibiæ with one spine between medial and terminal spurs ;

abdomen with some rough hair at base of dorsum. Forewing moderately broad, the apex not produced; veins 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. Hindwing with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6 7 shortly stalked or from cell; 8 anastomosing with the cell near base only.

1599. Protagrotis cuprea.



Protagrotis cuprea. ♂ $\frac{1}{1}$.

(*To be continued.*)

FURTHER NOTES ON THE BUTTERFLIES OF THE LUCKNOW DISTRICT.

By G. W. V. de Rhé-Philipe.

In 1902, after some three years and a half of collecting and observation in the district, I compiled a local list, which appeared in Vol. XIV. (pp. 481 *et seq.*) of the Journal of the Society. A transfer from Lucknow put an end, for the time being, to butterfly work there ; but the chances of service took me back for some months in 1903-04, and gave me a few further opportunities of adding to my collection of the district *Lepidoptera.* Pressure of official work limited these opportunities to occasional excursions in the near neighbourhood ; but I was able to add a few new names to my local list and to make some additional notes. These I give as a supplement to the original article. Furlough home has been answerable for the delay in writing them.

NYMPHALIDÆ.

Satyrinæ.

8. Mycalesis blasius—Fabr. This species was even more common during the rains of 1903 than I had ever known it before ; but continued very local. Curiously, spots I had known as certain finds in previous years were now absolutely blank ; while in others I had more than once previously unsuccessfully searched, a specimen or two could invariably be routed out.

Nymphalinæ.

20. Junonia atlites—Linn. I took two or three of this species in Lucknow in July and August 1903, and it can now be given a place in the local list with certainty.

23 (*a*). Neptis eurymene—Butler. I had an opportunity of examining a Neptis taken in Lucknow in September or October 1902, which was of this species. Its occurrence in the district is justified by its distribution, but it is probably very rare.

LYCÆNIDÆ.

52 (*a*). Iraota mæcenas—Fabr.

One male was taken in March. It is a much smaller insect than usual (being barely 1·2 inches in expanse) and the brilliant metallic scales so distinctive of the species are very few and scattered. It is thus, in appearance, somewhat different from others of the species (mostly from the Himalayas) in my collection ; but a careful examination removes all doubt of its identity. It is apparently very rare in the district ; and, like many other Lycenidæ, probably appears only as a spring brood.

55. Aphnæus elima—Moore.

61. Rapala melampus—Cram. I found considerable numbers of these species in May and early June, attracted by the scented flowers of a *Mimusops elengi,* a somewhat uncommon tree in the Lucknow District. Elsewhere they were as rarely met with as ever. Males predominated, and all the insects were dead and badly broken—being apparently the survivors of the spring broods.

PAPILIONEDÆ.

PIERINÆ.

74. APPIAS PAULINA—Cram. Another specimen—a male—of this rare species was taken in the Secunderabagh gardens in September.

74 (*a*). APPIAS HIPPOIDES—Moore. New to the Lucknow list. It is rare, only a single female—taken in September—being recorded in four years.

78 (*a*). LEPTOSIA XIPHIA—Fabr.—Taken for the first time in August 1903 at the height of the rains. It is apparently not very rare, but is extremely local, which probably accounts for an earlier capture not having been recorded. All I took were found in a very limited piece of damp, heavily overgrown ground, in a corner of the Secunderabagh gardens. The species was only on the wing a very short time—about a fortnight—and then disappeared altogether.

PAPILIONINÆ.

79. PAPILIO ARISTOLOCHIÆ—Fabr. I discovered numbers of eggs, larvæ in all stages of growth and pupæ, of this common papilio on various kinds of *Aristolochia* throughout July, August and September. Owing to frequent absences from Lucknow I was unfortunately unable to carry out any systematic course of breeding; it should not, however, be difficult to work out the life history of the species.

83. PAPILIO NOMIUS—Esper. I saw or took quite a number of these insects in July and August. Though never common, it may be considered regular, and my original note on the species thus needs some modification so far as its occurrence in the Lucknow District is concerned.

HESPERIDÆ.

84. BADAMIA EXCLAMATIONIS—Fabr. I found the eggs and larvæ of this species on the *Bignonia gracilis*, and the imago could generally be found round the plants. For reasons already given, I was, much to my regret, not able to do any breeding.

92. UDASPES FOLUS—Cram. I took one more specimen in September. It is a rare insect in the district.

I have also to add three new "Skippers" to the Lucknow list. All are apparently rare, as only single specimens of each were taken in four years.

94. SARANGESA DASAHARA—Moore. One taken in October.

95. PADRAONA GOLA—Moore. A single male in September 1903. On getting the new species, I captured and examined all others of the genus I saw, in the hope of finding some more of *P. gola;* but I never again took anything but *P. dara.*

96. PARNARA KUMARA—Moore (?). This was the only Parnara I ever took in Lucknow, and I have not been able to classify it to my satisfaction. It does not fully agree with any of those described by Watson in his "Hesperidæ Indicæ"; nor could I identify it with any of the species represented in the Calcutta Museum collection. The discal series of spots on the forewing are

arranged exactly as in *P. colaca,* Moore, but it lacks the spot inside the cell; the upper side of the hindwing is also unmarked. It appears more nearly allied to *P. kumara,* Moore (which I have doubtfully named it), but differs from Watson's description of the species in having *three* distinct discal spots on the underside of the hindwing, one just beyond the cell, and the other two between the first and second and second and third median nervules. The specimen was a male taken in September.

AN APPEAL FOR LIZARDS

By

F. Gleadow, I.F.S.

It was pointed out to me lately that the Society's collection of lizards is small and dwindling. In fact, lizards do not keep for ever, (witness one I was expected to name, Ugh!) and unless new specimens are sent in, a museum soon begins to deteriorate. Below will be found a catalogue of our collection, followed by a list of desiderata. It will be observed, by those gifted with sufficient perspicuity, that the latter list is the longer of the two. I. therefore, venture to ask the charitable and benevolent in all parts of India to collect and forward lizards of all kinds except those known to be very common. Persons who may not have been born lizard-catchers may feel diffident of success, but they have only to try and see that there is interest and some fun in this mild form of shikar. Lizards are not all taken with the same bait. A charge of small shot, a smart terrier, a fishing rod with a running noose at the end, will take the lizard if he will not take them. They may be caught by hand, chased with a stick in the hot weather (Professor Mugwump's cure for obesity), or dug out of the ground. The latter method is excellent in sandy country ; the burrows are not deep (except some of the *Agamidæ*). and if a twig is inserted in advance, the hole is not obliterated by fallen sand. Fingers should not be stuck up these holes, for they sometimes contain venomous snakes. It is rather fun seeing half a dozen native boys trying to catch a lively *Eremias* or *Calotes*. Many kinds live under dead bark or stones and are easily caught. Above all, do not flurry the Chameleons. A Chameleon *can* move his legs at the rate of one every 5 seconds, but he regards it as most indecent and undignified if he has to take more than a step every 25 seconds. So spare his feelings. He will open his mouth, but you can put your finger in and he will merely wonder when you are going to take it out again.

When the lizards have been caught, they may either be forwarded alive to the Honorary Secretary of our Society or killed by drowning, when after a small incision lengthways has been made in the abdomen, they should be placed in some weak spirit and water, and forwarded by post.

CATALOGUE OF LIZARDS

in the collection of the Bombay Natural History Society,

26*th May* 1905.

Number in Fauna of British India.	Scientific name.	Number of specimens.	Locality.
3	Crocodilus palustris	5	Tulsi Lake, Bombay.
59	Gymnodactylus deccanensis	2	?
60	Do. albofasciatus	2	?
85	Hemidactylus frenatus	1	?
86	Do. gleadovii	12	Campbellpore.
89	Do. maculatus	3	Salsette.
90	Do. triedrus	2	?
93	Do. leschenaultii	3	Khandesh.
94	Do. coctaei	1	Bombay.
100	Teratolepis fasciata	1	Gadag.
107	Gecko verticillatus	2	Burma and Java.
110	Ptychozoon homalocephalum	1	?
112	Eublepharis hardwickii	1	?
113	Do. macularius	5	Ghauts.
114	Draco maculatus	3	Burma.
115	Do. blanfordii	4	Do.
116	Do. dussumieri	3	?
118	Sitana ponticeriana	2	Lanowli, W. Ghats.
122	Cophotis ceylanica	2	?
123	Ceratophora stoddartii	5	?
124	Do. tennentii	2	Ceylon.
126	Lyriocephalus scutatus	1	?
132	Acanthosaura crucigera	1	?
137	Do. tricarinata	1	?
141	Salea anamallayana	4	?
145	Calotes versicolor	4	Bombay.
151	Do. nemoricola	1	Coonoor.
154	Do. ophiomachus	2	Ceylon.
155	Do. nigrilabris	4	?
156	Do. liscephalus	1	?
157	Do. rouxii	2	?
160	Charasia dorsalis	4	Coonoor and Bangalore.
162	Do. ornata	2	?
165	Agama tuberculata	3	Simla.
171	Do. nupta	1	Fort Sandeman.
179	Liolephis belliana	4	Burma.
180	Uromasti hardwickii	1	Kharagora.
181	Ophisaurus gracilis	1	?
182	Varanus griseus	2	Surat.
184	Do. bengalensis	2	?
186	Do. dumerilii	2	?
190	Acanthodactylus cantoris	4	Karachi.
191	Do. micropholis	2	Kutch.
192	Cabrita leschenaultii	2	Campbellpore.
200	Eremias velox	1	?
205	Mabuia dissimilis	4	Punjab.

Number in Fauna of British India.	Scientific name.	Number of specimens.	Locality.
211	Mabuia carinata	1	?
214	Do. multifasciata	1	Ceylon.
239	Lygosoma punctatum	1	?
240	Do. guentheri	1	Indore.
245	Do. lineatum...	1	Bombay.
255	Eumeces taeniolatus	2	Punjab.
259	Ophiomorus tridactylus	2	Sind.
261	Chalcides ocellatus	1	?
270	Chamaeleon calcaratus	2	Surat and Bombay.

LIST OF WANTS.

Number in Fauna of British India.	Scientific name.	Habitat.
*1	Gavialis gangeticus	Indus, Ganges, &c.
*2	Crocodilus porosus	East Coast.
48	Stenodactylus orientalis	Sind.
50	Alsophylax tuberculatus	Baluchistan, Sind.
51	Gymnodactylus fedtschenkoi	Salt Range.
52	Do. scaber	Sind (rocks).
54	Do. kachhensis	Cutch, Sind (rocks).
56	Do. lawderanus	Kamaon.
57	Do. nebulosus	S. India. Forests.
58	Do. jeyporensis	Jeypur. High Woods.
61	Do. oldhami	S. Kanara.
62	Do. triedrus	Ceylon.
63	Do. frenatus	Do.
64	Do. khasiensis...	Khasia Hills.
67	Do. variegatus...	Moulmein.
68	Do fasciolatus	W. Himalayas, Subathu.
69	Agamura cruralis	Baluchistan.
71	Gonatodes indicus and others	Nilgiris, Wynaad.
76	Do. mysorensis	Mysore.
80	Do. littoralis	Malabar.
81	Calodactylus aureus...	Tirupati Hills. Ravines.
82	Ptyodactylus homolepis	Sind Hills.
...	Hemidactylus various	All parts.
101	Gehyra mutilata	Ceylon, Burma.
...	Lepidodactylus various	Burma, Ceylon, S. India.
106	Hoplodactylus anamallensis	S. India.
108	Gecko stentor	Burma, Andamans.
109	Do. monarchus	Ceylon, Malaysia.
111	Phelsuma andamanense	Andamans.
117	Draco taeniopteris	Tenasserim, Siam.

* Small specimens required which can be kept in spirits.—Hon. Secs.

Number in Fauna of British India.	Scientific name.	Habitat.
119	Otocryptis bivittata...	Ceylon.
120	Do. beddomei...	Tinnevelly. Grass, 4,300 ft.
121	Ptyctolæmus gularis	Assam, Sadiya.
125	Ceratophora aspera ... ... ---	Ceylon.
127	Goniocephalus subcristatus	Andamans and Nicobars.
129	Do. bellii...	Bengal.
130	Do. grandis	Pegu ? Malaysia.
131	Acanthosaura armata	Malaysia, Siam.
133	Do. lamnidentata	Pegu, Tenasserim.
134	Do. minor	Sikhim and Khasi Hills.
136	Do. major	Sutlej Valley.
138	Japalura variegata	Sikhim, E. Bengal.
139	Do. planidorsata	Khasi Hills.
140	Salea horsfieldii	S. India.
...	Calotes various	All parts.
161	Charasia blanfordiana	S. W. Bengal. High Rocks.
...	Agama various	Himalayas. Deserts, Rocks.
...	Phrynocephalus various	Persia to Indus.
*183	Varanus flavescens	N. India, Burma.
*185	Do. nebulosus	Bengal, Burma.
*187	Do. salvator	Bengal, Burma, Ceylon.
188	Tachydromus sexlineatus...	Assam, Burma.
193	Cabrita jerdonii	Godavari Valley.
...	Ophiops various	All parts.
198	Eremias guttulata	Sind.
199	Do. brevirostris	Gulf, Punjab.
201	Do. fasciata	Persia, Baluchistan.
...	Mabuia various (brahminy lizards)	All parts.
...	Lygosoma various	Do.
246	Ablepharus brandtii...	Punjab, Sind, Baluchistan.
247	Do. grayanus	Cutch, Sind.
...	Ristella various	Hills, S. India.
252	Tropidophorus berdmorii	Pegu, Tenasserim.
254	Eumeces scutatus	Sind, Cutch.
256	Do. schneideri	Baluchistan.
257	Do. blythianus	Amritsar.
258	Scincus arenarius	Sind.
260	Ophiomorus blanfordii	Baluchistan, Persian Coast.
262	Chalcides pentadactylus	Sandy banks of Kuddle.
263	Sepophis punctatus	Golconda H., Gorge H.
264	Chalcidoseps thwaitesii	Ceylon.
...	Acontias various	Do.
269	Dibamus novæ-guineæ	Nicobars.

* Small specimens required which can be kept in spirits.—Hon. Secs.

A NEW MOUSE-HARE OF THE GENUS *OCHOTONA*.

As the result of "a large and valuable series of *Ochotona* from Kashmir, recently sent home by Colonel A. E. Ward," Mr. J. Lewis Bonhote was induced "to take up and study the whole genus, so far as the Palæarctic Region is concerned," and the results are published in the P. Z. S. 1904, Vol. II., p. 205, including the description of a new species collected by Colonel Ward.

For the convenience of Members we quote below the full description of this new species, of which Colonel Ward has contributed several specimens to our collection.

OCHOTONA WARDI, Bonhote.

Ochotona wardi, Bonhote, Abstr. P. Z. S. 1904, No. 10, p. 13, Nov. 22.

In the summer pelage, worn from June to September, the whole of the head, shoulders, and fore-part of the body (excepting a small patch behind the ears, which is white) is bright chestnut (cinamon-rufous, Ridgw.), becoming more vinaceous on the throat. The remainder of the upper parts is dark greyish rufous, each hair being black at its base with a light sub-terminal annulation, the tips being either dark or rufous. This latter colour encroaches greatly on the light portion often to its total exclusion, especially on the sides of the body. The underparts are white lightly washed with pale buff. The feet are of the same colour. Ears moderate in size, very scantily clothed with hair.

In the winter pelage this animal is of a uniform dark iron-grey all over, with the exception of the light patches behind the ear, which are white as in summer. Underparts dull white. Slight traces of rufous are generally to be found at the base of the shoulders, on the crown of the head, and along the flanks. The young resemble the adults in winter, but are slightly browner in general colour and have the rufous on the head and shoulders more marked.

The *skull* is very similar to that of the type of *O. roylei*, as figured in the original description, and does not show any great features of note. The combined foramen, while having the narrow anterior third and the slight constriction typical of the *rufescens* group, shows a tendency for the constriction to become less marked, but it can nevertheless be clearly made out in every example.

Dimensions of type in flesh. Head and body 187 mm.; hind foot 25; ear 22·5.

Skull.—Greatest length 44 mm.; basal length 37; palatal length 17; length of foramen 12; Zygomatic breadth 21; interorbital breadth 5; breadth of brain-case 17; length of molar series 9.

Habitat.—Talien, Kashmir, 11,000 feet.

Type (in Coll. Brit. Mus.). A. E. W. No. 56. Ad. ♂.

Collected on the 8th August, 1903.

In external appearance this species most nearly resembles *O. roylei;* the latter, however, is much darker and lacks the conspicuous white patches behind the ears.

(*From the Proceedings of the Zoological Society of London,* 1904, *Vol. II., Part II.*)

(*From the Proceedings of the Zoological Society of London,*
1905, *Vol. I, Part I.*)

DESCRIPTIONS OF THREE NEW SPECIES OF BIRDS OBTAINED DURING THE RECENT EXPEDITION TO LHASSA BY HENRY E. DRESSER, M.B.O.U., F.Z.S.

[*Received January* 17, 1905.]

* (Plates IV and V.)

Col. Waddell, C.B., who has recently returned from India, having been one of the officers on the Tibet Expedition, when there made a collection of birds, most of which, he tells me, he was able to identify by my "Manual of Palæarctic Birds". Some, however, he failed to recognize, and these he kept by him, and has sent them on to me for identification, requesting me to describe any that are new. The rest, however, were with his baggage, and were unfortunately lost on the return march from Lhassa.

Amongst the birds which were fortunately saved I find the following to be undescribed, *viz.*:—

Babax waddelli. sp. n. (Plate IV.)

Adult male. (Tsangpo Valley, Tibet, 25th September 1904).—Upper parts dull ashy grey, each feather with a broad central blackish stripe, the rump slightly less striped than the rest of the upper parts; wing blackish brown, most of the feathers externally margined with ashy grey; tail blackish brown, much graduated; under parts similar to the upper parts, but somewhat paler and more narrowly striped; bill and legs plumbeous, iris dull orange. Total length about 12·60 inches, culmen 1·40, wing 5·10, tail 6·50, tarsus 1·70.

The nearest ally to this species appears to be *Babax lanceolatus*, from which, however, it differs considerably, being larger (wing 5·10 against 3·75, tail 6·50 against 5·0), and, as will be seen by the above description, it differs considerably both in colour and markings. It is, Col. Waddell says, "called by the Tibetans '*Teh-Teh*,' in imitation of its call. It frequents poplar and older thickets remote from villages. It was gregarious, going about in parties of 8 to 10 individuals, but was not so active and secretive in its movements as the *Garrulax*, alongside of which it was met with."

Garrulax tibetanus, sp. n. (Plate V, Fig. 2.)

Adult male. (Tsangpo Valley, Tibet, 25th September 1904).—Upper parts dark brown with a tinge of olivaceous, the crown slightly darker; lores and a patch through the eye with the ear-coverts blackish chocolate; quills blackish, externally margined with slate or dark lavender-grey; wing-coverts like the back; tail graduated, blackish brown broadly tipped with white;

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* These Plates have not been reproduced but will be found in the Proceedings of the Zoological Society of London, Vol. I, Part I, 1905.

underparts rather paler than the upper parts ; a broad white stripe below the eye, and a few white feathers above the eye indicating a stripe ; under tail-coverts and lower flanks chestnut-red. Bill and legs dark plumbeous, iris dull crimson. Total length about 10·50 inches, culmen 0·90, wing 4·50, tail 6·40, tarsus 1·50.

From its nearest ally *Garula sannio,* this species differs in having the upper parts much darker and more uniform in colour, the crown not chestnut-brown, the under parts darker, without any white or ochraceous on the belly, and in the tail having a broad white terminal band. Colonel Waddell informs me that " it is called by the Tibetans ' *Jomo,*' or the Lady ; it is found in the same poplar and older thickets as the *Babax*, but also comes up quite close to the villages. It has the characteristic habits of a Babbler in a marked degree, roves about in parties of eight or more individuals, chatters more noisily uttering its fluty call of *Whoh-hee, Whoh-hee,* is always on the move, scampering along the branches, is very secretive seldom showing itself and flying very low across a clearance to the next cover."

LANIUS LAMA, sp. n. (Plate V, Fig. 1.)

Adult Male. (Tsangpo Valley, Tibet, September 1904.) Head, nape, and upper parts generally dark plumbeous much as in *Lanius algeriensis,* a narrow line across the forehead, the lores, and a broad band through and behind the eye deep black ; lower rump and upper tail-coverts rufous ; wings black the inner secondaries and larger wing-coverts narrowly margined with dull white, tail uniform blackish brown, rather pale at the extreme tip ; under parts white, the breast, flanks, and under tail-coverts washed with rufous fawn. Total length about 10·10 inches, culmen 0·83, wing 4·20, tail 5·0, tarsus 1·12.

Lanius schach appears to be the nearest ally to the present species, but the latter has only a narrow black line across the forehead, the upper parts are much darker, it has no rufous on the back or scapulars, but only on the lower rump and upper tail-coverts, and has no trace of a white alar speculum.

The other birds sent are *Pica bottanensis, Turtur orientalis, Otocorys elwesi,* a young Lark which I cannot separate from *Alauda arvensis* and *Parus cinereus,* which however, has a slightly larger bill and longer wing than typical examples, but without a series it is impossible to say if it can be regarded even as a subspecies.

All the above-mentioned birds were obtained in the Tsangpo Valley, near the Chuksam Ferry, at an elevation of 12,100 feet above the sea-level.

(*From the Proceedings of the Zoological Society of London*, 1905, *Vol. I., Part I.*)

ON DOLPHINS FROM TRAVANCORE.

By R. Lydekker.

(*Received December 30th*, 1904.)

† (Plate XIII.)

For some years past all specimens of Dolphins stranded on the shore or caught by the fishermen in their nets in the neighbourhood of Trevandrum, Travancore, have been collected and preserved by the officials of the Trevandrum Museum. This excellent work was begun by the late Director, Mr. Harald Ferguson, and, I am glad to say, is being continued by his successor, Major F. W. Dawson. In most cases careful measurements have been taken of the specimens in the flesh, while excellent coloured sketches have been made of the more important examples by Mr. C. S. Mudaliar. After the completion of the measurements and drawings, the skeletons have been prepared—some of them, I am glad to say, having been presented to the British Museum.

As the result of the drawings and specimens sent to me by Mr. Ferguson, I have (in addition to representatives of other genera) been enabled to determine two apparently distinct species of the genus *Tursiops*, of both of which coloured figures have been published in the "Journal of the Bombay Natural History Society."* To the one I gave the name *T. fergusoni*; while the second I identified provisionally with the Australian *T. catalania*. Since the publication of the second of the papers just referred to, I have received from Trevandrum sketches of two other Dolphins taken off that coast. The first of these (Plate XIII, Fig. 1) is one of a pair taken in the autumn of 1903; while the second (Plate XIII, Fig. 2) was captured in October 1904. Curiously enough, both appear to belong to the genus *Tursiops*; and, what is more curious still, they are unlike either of the two specimens figured in the papers referred to above.

Regarding the specimen taken in 1903, Mr. Ferguson wrote to me as follows:—

"I sent off last week a case containing the skeletons of two Dolphins caught here lately. They are of the same species, and I think of the genus *Tursiops*. They are very closely allied to, if not identical with, *T. catalania*; but they have no blotches at the sides, and they have a dark blue band running from the eye to the front of the adipose elevation, as in the common Dolphin. This band is much less conspicuous in the larger and older specimen, and may possibly disappear altogether with age. I send measurements of the two specimens, and a sketch of the larger one, in which the blue line is only faintly shown."

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* Vol. XV., pp. 41 and 408, plates B. and C. It may be noticed that in the second of these papers no references are made to the first; this is owing to the fact that copies of the former had not been received in England at the time the latter was written.

† This Plate has not been reproduced but will be found in the Proceedings of the Zoological Society of London, Vol. I., Part I, 1905.

The following is the description of these specimens as given by Mr. Ferguson:—

Descriptive notes on two Cetaceans caught at Villinjam in nets by fishermen on October 15th, 1903, and obtained by purchase.

Smaller Specimen.

	Ft.	In.
Length from tip of snout to the median cleft on the tail-flukes	5	10
From tip of snout to origin of dorsal fin	2	8
,, ,, pectoral fin	1	8
,, ,, genitals	3	10
,, ,, anus	4	3
Anterior margin of pectoral fin along the curve	1	2
,, ,, dorsal	1	0
Tail-flukes along the curve	1	0½
Expanse of tail	1	6
Beak from groove which separates the forehead	0	5½
Genital groove } close together	0	4½
Anus } close together	0	0½
Length of mouth from gape	0	10½
Greatest breadth	0	11
,, height	0	11¾
,, circumference	3	1
Smallest circumference, at root of tail	0	8½
Height of dorsal fin	0	7½
Length of dorsal fin at base	0	9½

Lower jaw about half an inch longer than upper. Colour dark plumbeous, paler about the sides, reddish ashy below. A dark blue band running from the eye to the front of the adipose elevation on both sides, one inch broad at the eye, tapering to a quarter of an inch at the front. Genital and anal regions fleshy pink. Jellyfish in stomach.

Teeth $\frac{24}{25}$ and $\frac{24}{26}$ = 49 and 50.

Ribs 12 pairs, of which the first four pairs are two-headed. One ossified presternum and two mesosterna; xiphisternum membranous.

Vertebræ: C. 7, D. 12, L. 16, Ca. 23 = 58.

Pterygoids not in contact.

Larger Specimen.

	Ft.	In.
Length from the tip of snout to the median cleft on the tail-flukes	6	8
From tip of snout to origin of dorsal fin	3	0
,, ,, pectoral fin	1	8
,, ,, genitals	3	9½
,, ,, anus	4	7
Anterior margin of pectoral fin along the curve	1	3

Anterior margin of dorsal	1	3½
Tail-flukes along the curve	1	3
Expanse of tail	1	7½
Beak from groove which separates the forehead... ...	0	5
Genital groove	0	5
Anal opening	0	1¼
Gape of mouth	0	11
Greatest breadth	1	0½
„ height	1	0½
„ circumference	3	2½
Smallest circumference	0	10
Height of dorsal fin	0	8½
Length of dorsal fin at base	1	0
Greatest circumference	0	10½
Smallest circumference	0	6½

Lower jaw about half an inch longer than upper. Colour blue-black, paler at the sides ; beneath fleshy grey. Lower jaw dull grey ; a dark blue band, same as the smaller specimen, but less clear. Genital and anal regions fleshy pink.

Teeth $\frac{27}{28}$ and $\frac{26}{27}$=55 and 53.

Vertebræ: C. 7, D. 12, L. 16, Ca. 23=58.

Ribs 12, of which five are two-headed.

Pterygoids not in contact.

The following are the particulars of the 1904 specimen supplied to me from the Trevandrum Museum :—

	Ft.	In.
Extreme length	6	1
From tip of beak to origin of dorsal fin	2	7½
„ „ „ flipper	1	5
„ „ anal opening	4	3
Length of flipper round the outer curve	1	2
„ dorsal fin	1	1
Expanse of tail-flukes	1	4½
Greatest height including dorsal fin	1	6¾
Height of body	1	0
Greatest girth	3	3
Smallest girth	0	9

Lower jaw somewhat protruding.

Colour.—Upper surface, flippers, and sides of tail glistening dark brown abruptly passing into dull silvery grey (paling into light sea-green after skinning) on the sides ; facial region paler ; underside dull pearly white, extending to a little behind the anal opening ; orbits in a dark brown oval blotch, which gradually fuses into a tapering band running above and parallel to the basi-rostral groove and uniting at the angle of the (V-shaped) prenarial adipose elevation, from which four dark faint lines diverge towards the forehead; the inner enclosing a pale lappet-shaped zone which includes the narial aperture, and the outer becoming obsolete halfway up.

Eyes dark reddish brown.

Lower jow lighter than upper.

Lips dull whitish. Fins falcate.

Length of skull 16·3 inches; breadth 7·6 inches.

Symphysis much shorter than one-fourth total length of mandible.

Teeth $\frac{27}{27}$ and $\frac{27}{26} = 54$ and 53. Simple, conical, and pointed, more or less compressed towards the root; anteroposterior diameter 6·5 mm. Two teeth in the premasillæ, and the first two mandibular ones, which were concealed in the gum, much smaller (diameter 2 mm.).

In spite of its being a somewhat immature specimen apparently referable to the genus *Tursiops,* which it resembles in many respects, the pterygoids are widely separated in the middle line, with the posterior border divergent.

Vertebræ: C. 7, D. 13, L. 15, Ca. 25 = 60.

The atlas and axis only fused together.

Ribs 13, the first four two-headed.

Other characters as in *T. fergusoni.*

From the general characters of the specimen, the number and size of the teeth, the vertebral formula, and the relative shortness of the mandibular symphysis, I cannot but conclude that its reference to *Tursiops* is correct. It is true that in the divergence of the pterygoids it differs from the typical *T. tursio;* but since the same feature occurs in the specimen identified with *T. catalania,* this affords no grounds for generic separation.

In the following table are given the dental and vertebral formulæ of the Dolphins assigned to the genus *Tursiops,* inclusive of the present specimens:—

1. *Tursiops tursio* (Fabricius).
   Teeth $\frac{22}{22} = 44$.
   Vertebræ: C. 7, D. 13, L. 17, Ca. 27 = 64.
   Pterygoids in contact.
2. *Tursiops abusalam* (Rüppell).
   Teeth $\frac{26}{26} = 52$.
   Vertebræ: C. 7, D. 12, L. 16, Ca. 26 = 61.
   Pterygoids (?) in contact.
3. *Tursiops* sp. (Trevandrum, 1904.)
   Teeth $\frac{27}{27}$ and $\frac{27}{26} = 54$ and 53.
   Vertebræ: C. 7, D. 13, L. 15, Ca. 25 = 60.
   Pterygoids divergent.
4. *Tursiops fergusoni,* Lydekker.
   Teeth $\frac{25}{25}$ and $\frac{26}{25} = 50$ and 51.
   Vertebræ: C. 7, D. 13, L. 17, Ca. 24 = 61
   Pterygoids divergent.

5. *Tursiops catalania* (Gray).
   Teeth $\frac{25}{25} = 50$.
   Vertebræ : C. 7, D. 12, L. 15, Ca. 24 = 58.
   Pterygoids divergent (?).
6. *Tursiops paruimanus* Lütkeu.
   Teeth $\frac{25}{24} = 49$.
   Vertebræ=62.
7. *Tursiops gilli* Dall.
   Teeth $\frac{22}{22}$ and $\frac{23}{22} = 44$ and 45.
   Vertebræ (?)
8. *Tursiops* sp. (Trevandrum, 1903.)
   Teeth $\frac{27}{28}$ and $\frac{26}{27} = 55$ and 53, or (in young) $\frac{24}{26}$ and $\frac{24}{26} = 49$ and 50.
   Vertebræ : C. 7, D. 12, L. 16. Ca. 23 = 58.
   Pterygoids divergent.

In this table No. 3 is the specimen figured in Plate XIII, Fig. 2, and No. 8 the one shown in Plate XIII, Fig. 1.

As regards the former, it will be seen that, both in respect of the dental and the vertebral formula, it comes nearer to *T. abusalam* of the Red Sea than to any of the others ; and indeed it would take very little (the loss of one tooth a-side, which occurs in one instance, the transference of a dorsal vertebra to the lumbar series, and the addition of a caudal vertebra) to make the two identical in these respects. On the other hand, *T. abusalam* is said to have the pterygoids in contact, or, at all events, it is not stated to differ in this respect from *T. tursio*, but I do not attach much importance to this.

The colouring of the type, and apparently only known, specimen of *T. abusalam* is given as follows in the original description :—

"Upper surface of the head and body, the tail and fins, dark sea-green. Margin of the upper lip, and entire undersurface of the body to the anus whitish flesh-colour ; belly with small, irregularly distributed, dark green spots. Iris dark green."

With the exception that there appears to be no white margin to the upper lip in the Indian specimen, this description accords well with the general colour of the former (especially when dried). On the other hand, the Indian specimen shows no spots on the belly (which may be a character of immaturity), and the iris is described as brown instead of green. In point of size (that is to say, in being smaller than *T. tursio*) the two agree sufficiently well ; and in both there is the same marked projection of the lower in front of the upper jaw. The more pronounced elevation of the region of the below-hole in the type of *T. abusalam*[*] may probably be explained by the greater age of the specimen.

On the whole, I am inclined to regard the specimen under consideration as being the immature form of *T. abusalam*, but it may be that the absence of spotting on the belly is distinctive of the Indian form at all ages, although I do not think this probable.

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[*] See True, Bull. U. S. Nat. Mus. No. 36, pl. ix, (1889).

With regard to the two specimens from Trevandrum, figured in the "Journal of the Bombay Society" as *T. fergusoni* and *T. catalania*, I am inclined to think that the former is the immature form of the latter*, despite the difference in the number of the dorso-lumbar vertebræ†. Now, if colour be worth anything in this matter (and if it be not, we have practically nothing to go upon), the type of *fergusoni* cannot be identical with the specimen here referred to *abusalam*, as both are immature specimens. Moreover, the specimens described as *fergusoni* and *catalania* differ from *abusalam* (type and young) by the general colour of the upper-parts being dark slaty instead of greenish (when the skin is dry) and in the orange tinge of the under-parts. Accordingly, if both the former belong to *catalania* (and I have practically no doubt as to the correctness of the identification of the adult), that species would appear to be distinct from *abusalam*. In addition to the difference of colour, it would seem to have fewer teeth and one caudal vertebra less.

Turning now to the specimen represented in Plate XIII, Fig. 1., it might appear at first that this is the adult of the one figured in Fig. 2 of the same Plate, if we could assume the disappearance of the light under-parts with age. In the first place, there is, however, no evidence that such a change takes place in this group of Dolphins; in the second place, the specimen in Fig. 1 was accompanied by a younger example which had the same coloration; and, in the third place, the adults of both *T. abusalam* and *T. catalania* have light under-parts, as is also the case with *T. tursio*.

Accordingly, it would appear that the Dolphin shown in Fig. 1 of the Plate, which is certainly a *Tursiops*, is distinct from these three species. Now the only member of the genus, which is wholly black, with the under-parts somewhat lightened, is *T. gilli*, of the Pacific coast of North America, described on the evidence of the skull, and only known in the flesh by "momentary observations," taken by Scammon. If this evidence be trustworthy, I cannot separate the Trevandrum specimen from *T. gilli*, so far as colour is concerned.

As regards the number of the teeth, this is less in the type mandible of *gilli* which is immature, and also in an aged skull; and it is possible that in the one case the full number may not have appeared, and that in the other some may have been lost. In any case, the difference is not very great or important.

That a North-Pacific Dolphin should be met with on the coasts of India is little, if at all, more improbable than the occurrence there of an Australian form (*T. catalania*). Accordingly (till evidence to the contrary be forthcoming) I propose to regard the specimen represented in Plate XIII, Fig. 1 as *T. gilli*.

If I am right in the foregoing identifications (and the difficulty of the subject is so great that every determination must be regarded as more or less provisional), we shall have the following external characters of the definable species of *Tursiops*:—

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* I had not the figure of *T. fergusoni* when describing *T. catalania*.

† Differences in the number of dorso-lumbar vertebræ in several species of Dolphin are noticed in Mr. True's memoir.

1. *Tursiops tursio.* European Seas.*
   Size large: 9 ft. 6 in.
   Upper surface blackish.
   Under-parts white and unspotted.
2. *Tursiops abusalam.* Red Sea and Indian Ocean.
   Size smaller: 7 ft. 2½ in. (type), 6 ft. 11 in. (India).
   Upper surface dark greenish.
   Under-parts whitish and spotted with green in adult; whitish in young.
3. *Tursiops catalania.* N. Australia to Indian Ocean.
   Syn. *T. fergusoni.*
   Size about the same as last: 7 ft. 8 in. (type), 7 ft. 4½ in. (India).
   Upper surface dark slate.
   Under-parts yellowish†, flecked with lead-colour.
4. *Tursiops gilli.* N. Pacific to Indian Ocean.
   Size, Indian specimen, 6 ft. 8 in.
   Whole surface blackish, tending to lighten slightly on the under-parts, with a tinge of reddish in Indian specimens.

Whether or no I am right in any or all these identifications, the colored figures of the Trevandrum specimens cannot fail to be of great value in future researches on the subject; and I venture to hope that the authorities of the Trevandrum Museum will continue their excellent practice of sketching and preserving every Dolphin that may come to hand.

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*Till further evidence, I should doubt the occurrence of this species in the Indian Ocean.

† In the type the under-parts are said to be whitish; if the orange tint of the Trevandrum specimens is a specific character, then the name *T. fergusoni* will be available for the Indian form.

(*From the Annals and Magazine of Natural History, No. XCIII, September* 1905.)

ON A REMARKABLE NEW SQUIRREL FROM BURMA.

By Oldfield Thomas.

The British Museum owes to the kindness of Captain H. H. Harington, of the 90th Punjabis, two specimens, from the Upper Chindwin River, of a very remarkable squirrel, quite unlike anything we have seen before. I would propose to call it

Sciurus Haringtoni, sp. n.

A pale creamy-buff species with a buffy belly and a whitish tail.

Size medium. Fur of back rather over 20 mm. in length. General colour of upper surface " cream-buff " along the dorsal area, the buff fading out on the sides, which are dull whitish. Individually the hairs of the back are whitish grey basally, with a broad cream-buff subterminal band and a minute black point. Head creamy whitish, with a slight buffy suffusion on the crown ; the cheeks dull white. Ears whitish, both outside and in. Under surface, from chin to anus, bright sharply contrasted ochraceous buff (in the type ; the second specimen nearer tawny ochraceous). Lateral line of demarcation very sharply marked in both specimens, and in the type emphasized by a blackish line which runs from the middle of the front of the forearm, across the shoulders, down the sides and legs to the back of the heel. Fore limbs on outer side above this line of demarcation creamy-whitish, like the flanks ; beyond it, including the hands and the whole of the inner aspect, ochraceous buffy like the belly, or slightly paler. Back of upper part of hind leg whitish like body ; inner side, ankles, and feet buffy like belly, rather paler on the digits. Tail above and below creamy-buff proximally (the extreme tips of the hairs blackish), lightening to white terminally.

Skull of the general proportions of that of *S. Finlaysoni*, *erythraeus*, &c., but there is only one upper premolar in the single specimen of which the skull has been preserved. This has the milk-premolar still in place, and the large permanent premolar just coming up below it, but no trace of the small p^3, which usually at this stage is readily discernible.

Dimensions of the type (measured in the flesh) :—

Head and body 250 mm. ; tail 265 ; hind foot (s. u.) 54 ; ear 22.

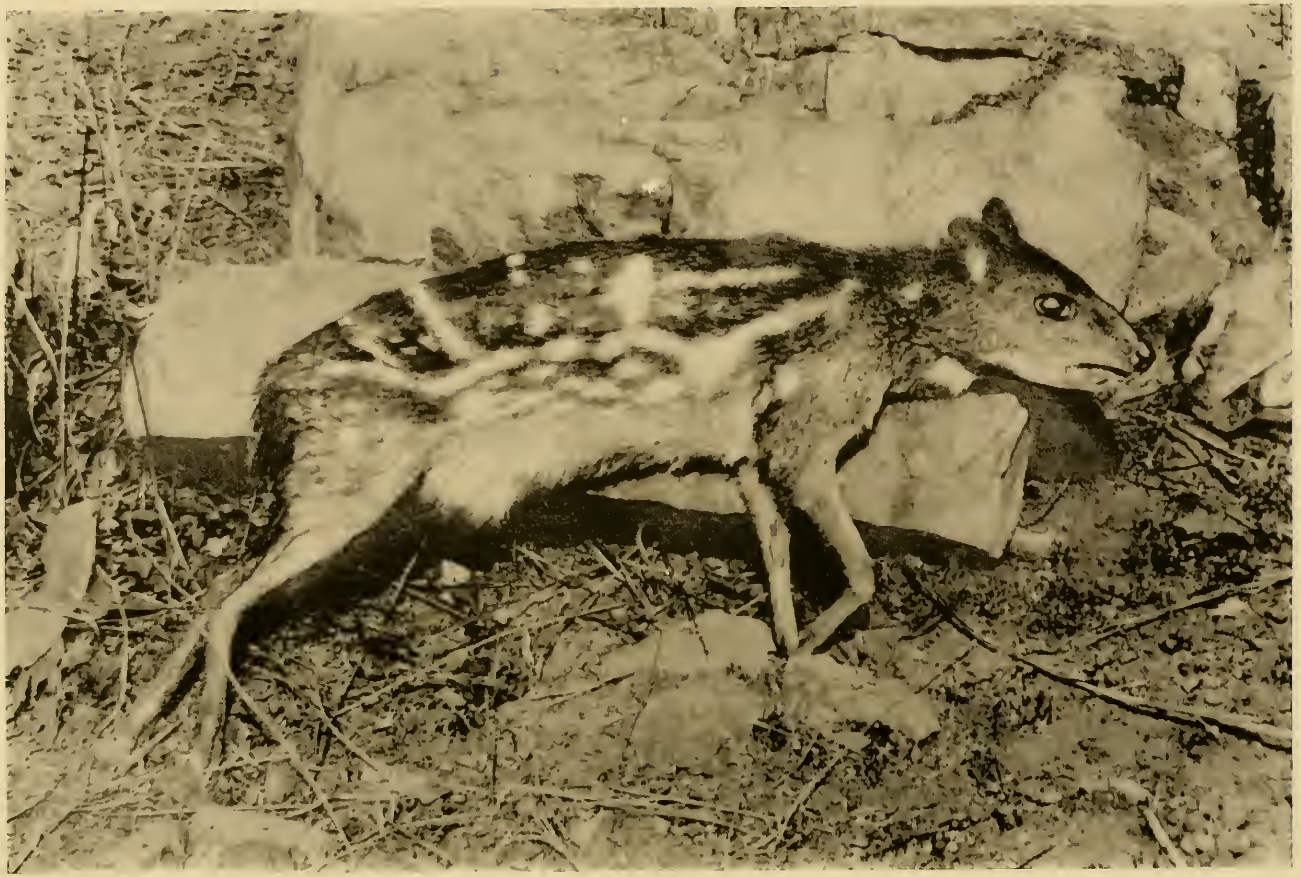
Skull : zygomatic breadth 32 ; back of postorbital process to tip of nasals 32·5 ; nasals 16·4 × 7·2 ; interorbital breadth 18 ; palate length 23 ; length of upper tooth-series 10.

Hab.—Upper Chindwin River, Burma. Type from Moungkan ; a second specimen from Homalin. About 25° N., 95° E.

Type.—Immature male. B. M. No. 5. 8. 11. 1. Collected 14th December, 1904, and presented by Captain H. H. Harington.

This very peculiar squirrel is so entirely unlike any known species that I do not know with what to compare it. Its pale creamy-buff colour and whitish tail are quite unique, while no other Oriental squirrel of its size is without the small upper premolar. This latter character also indicates that *Sciurus Haringtoni* is not merely a partially albinistic variation of some known species, an explanation which its pale colour might at first sight suggest.

Captain Harington is to be congratulated on the discovery of so striking a new form.



J. Green Photo. Imp.

THE INDIAN CHEVROTAIN, OR MOUSE DEER.

(Tragulus Meminna.)

MISCELLANEOUS NOTES.

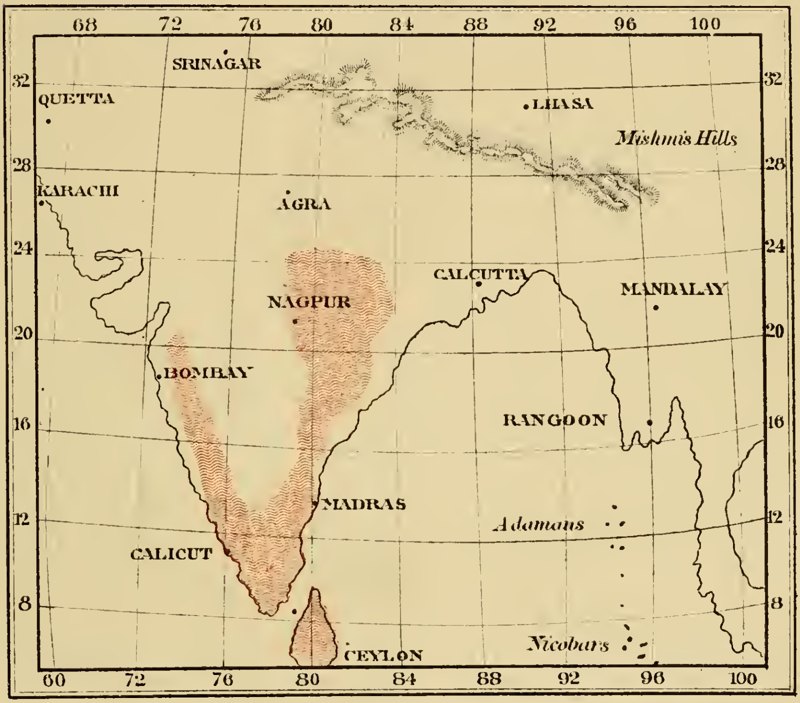
No. I.—THE INDIAN CHEVROTAIN OR MOUSE-DEER (*TRAGULUS MEMINNA*).

(*With a Photograph and Map.*)

I send you herewith a photograph of the Indian Mouse-deer or Chevrotain,

Journal Bombay Nat. Hist. Soc. Vol. XVI.

KEY MAP OF THE INDIAN REGION.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Mishmis Hills
KARACHI
AGRA
CALCUTTA
MANDALAY
NAGPUR
BOMBAY
RANGOON
MADRAS
Adamans
CALICUT
CEYLON
Nicobars
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CORTEZ & CO. LITH. BOMBAY.

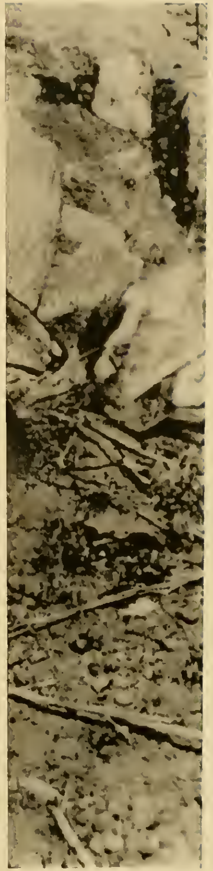
THE RED SHOWS THE PROBABLE DISTRIBUTION OF THE "MOUSE DEER" (TRAGULUS MEMINNA) ACCORDING TO BLANFORD.

the mountains of Western China. As forming a connecting link between these localities, its occurrence in the Shan States is of interest.

E. COMBER, F.Z.S.,
Hon. Sec., Ornithological Section, Bo. Nat. Hist. Socy.

BOMBAY, 20*th June* 1905.

Journ. B



J. GREEN PHOTO. IMP.

MISCELLANEOUS NOTES.

No. I.—THE INDIAN CHEVROTAIN OR MOUSE-DEER (*TRAGULUS MEMINNA*).

(*With a Photograph and Map.*)

I send you herewith a photograph of the Indian Mouse-deer or Chevrotain, which I shot in the Raipur District, Central Provinces, last year. It may be of interest to many of our members, as this little animal is seldom seen and I do not think a picture of it has ever been published in our Journal.

E. BROOK FOX.

BANKIPUR, BENGAL, *3rd January*, 1905.

[Mr. Brook Fox is quite right in saying that we have never published a photograph of this shy little animal, but a good picture of it appears in the "Fauna of British India," (Mammalia), page 555, showing the little "tushes," or long upper canines, with which the male is provided. These are not visible in Mr. Brook Fox's photograph now reproduced, but perhaps his specimen was a female.

According to the above authority this small animal has never been recorded as occurring in Bengal proper, Behar, the N. W. P., Rajputana, the Bombay Deccan (away from the Western Ghats), Berar, or the Central Provinces West of Jubbulpore, Sioni and Nagpur. Mr. Blanford gives its distribution as Ceylon and Southern India, (in forests at elevations below 2,000 feet) extending northward to Orissa, Chutia Nagpur and the Eastern Central Provinces; also along the Western Ghats to North of Bombay.

The occurrence of this animal in northern India requires confirmation.

EDITORS.]

No. II.—INTERESTING BIRDS FROM THE SHAN STATES.

Included in a very nice series of bird skins received some time ago from Captain H. Wood, R.E., that he collected in the Northern Shan States, were two specimens of special interest.

One is a male of a Rose-Finch (*Carpodacus vinaceus*) that has only been previously recorded as occurring in Western China and this species can consequently now take its place amongst those found in British Burma.

The other is *Procarduelis nepalensis* (The Dark Rose-Finch), which is known on the Himalayas from Kashmir to Bhutan and has also been recorded from the mountains of Western China. As forming a connecting link between these localities, its occurrence in the Shan States is of interest.

E. COMBER, F.Z.S.,
Hon. Sec., Ornithological Section, Bo. Nat. Hist. Socy.

BOMBAY, *20th June* 1905.

No. III.—THE NESTING OF SOME BIRDS IN BURMA WHICH HAVE NOT BEEN RECORDED BEFORE.

SUTHORA BRUNNEA.

I was fortunate in finding four nests of this interesting little bird, up at Sinlum Kaba (6000 feet), Bhamo District, Upper Burma. The first nest was found on the 30th May in a patch of reeds growing in the Government garden. The birds first attracted my attention by their continuous twittering while my dog was working in some long grass and reeds growing in a swamp. I felt certain that there was a nest somewhere near, so carefully marking the spot I went away. On returning, sure enough a bird got up somewhere, but it was impossible to say where, so by repeating the practice three or four times I was fortunate at last in seeing the exact clump from which the bird came out of, and so found the nest, which was placed in the middle of a clump of reeds and about 18″ from the ground and well concealed and would have been impossible to find unless the bird had been seen leaving. It took me a whole afternoon to finding the nest and shooting the parent bird. The nest was rather a deep cup-shaped structure composed of bamboo leaves and coarse blades of grass and lined with finer grass and a few horse hairs, measuring about 4″ × 3½″ outside and 2″ × 2″ inside. It contained 3 highly incubated eggs of a pale bright blue measuring about ·7 × ·55. The other nests were easier to find after the birds' note and habits were known. As in each case they drew attention to their whereabouts by their twittering. I used to then mark the spot with a stick and go away and sit down, as soon as all was quiet I came back when the noise would begin again, by doing this a few times the bird would be seen leaving and then after a careful hunt most probably the nest would be found. The three nests were found near each other on the same spur of the hills on the 1st of June, and were placed as follows:—One in a clump of thatching grass at about one foot from the ground, another placed on a bramble in some grass about 2 feet from the ground, and the third in a patch of grass growing under a thornbush, and contained 3 young birds, 3 eggs and 2 eggs, respectively, the eggs were hard set but blowable after a few days' water treatment.

The birds seem to inhabit long grass and reeds where they creep about and rarely fly, they are often heard but seldom seen. I also shot a specimen of *S. poliotis* (No. 56) up at Sinlum. This had all the habits of a tit and was got in the tree jungle while hunting after insects fairly high up from the ground.

PYCNONOTUS XANTHORRHOUS—ANDERSON'S BULBUL.

(Kochin name—Kator Tor Phrong).

Sinlum Kaba is a great place for Bulbuls and I think I saw at least six different kinds, amongst them *S. canifrons* which also was breeding. *P. xanthorrhous* was however the commonest. I was unfortunately too late for the majority of birds which had all hatched out and the young birds on the wing. I however found two nests, one containing two fledglings and one addled egg and the other 3 hard set eggs. Both were found in scrub jungle and placed about 3 feet from the ground, and were of the usual Bulbul type but more compact and neatly made. The eggs pinkish-white with the usual red and purple spots and average about ·86″×·58″. The nests were found on the 30th and 31st May. Any one being up at Sinlum a month earlier ought to make a good collection of Bulbul's eggs judging from the number of young birds seen about.

Oreicola jerdoni—Jerdon's Bush-Chat.

Last year I saw this bird in numbers in the Upper Cuniduni District North of Kindat, but failed to find its nest. This year I found it up here at Bhamo inhabiting a swamp of kine grass or Briar Jungle at the bottom of the Polo ground This jungle consists of patches of Elephant grass mixed up with a sort of Briar rose and thatching grass, and almost impossible to work in. I marked down with small flags at least half a dozen cock birds who shewed a great anxiety on any one going near their own particular patch of jungle, it was another thing to find the nests, as it was impossible to watch the birds owing to the height of the grass. My only hope was to try and frighten the bird of its nest, but this was almost impossible as the cock bird kept a very good look out and always gave the alarm when the hen bird would appear from nowhere, and very often was never seen at all, most probably keeping hid in the long grass. On the 21st May I managed to take a couple unawares by coming quietly round a corner when I saw a hen bird dart out from under a bush. I at once marked the spot and then had the brambles cut away carefully. At last after a careful search we found the nest on the ground and completely hidden in the long *dhoob* grass which was growing under the brambles, and placed about 3 feet from where the edge of the bush had been. The nest was composed of fine grass and roots lined with a few feathers and contained four eggs, which unfortunately were on the point of hatching and were cracked all over, so that only the pieces could be kept. The eggs were a pale blue green without any spots and of the same size as those of *O. ferrea.* This I fancy is one of the most difficult birds to watch and find the nests of, owing to the kind of jungle they inhabit. I hope for better results next year if still in these parts.

Æthiopsar grandis and albicinctus, the Siamese and Collared Mynas.

These are very common birds up here. I found a colony of them nesting in the sides of the Fort moat. The nests were in holes where bricks had been omitted and the majority out of reach. I found one nest of the Collared Myna containing four eggs, one of which is spotted with brown and very highly coloured, in fact very like an English Thrush's egg, only the spots are brown instead of black.

H. H. HARINGTON, Capt.

Bhamo, 9*th June* 1905.

No. IV.—ALBINISM IN THE BLACK BUCK.

(*With an Illustration.*)

In the Society's Journal, Vol. XVI, No. 2, there is, at page 361, a photograph and a note on the occurrence of Melanism in the Black Buck (*Antilope cervicapra*). The photograph, which I send you, represents the opposite condition, *viz.*, Albinism. The buck in question is a full grown male with a perfect snowy white coat and the usual "pink" eyes of an albino. The hoofs and horns are also curiously pale and equally devoid of pigment.

The buck was presented by H. H. the Raja of Faridkote to his Honour the Lieutenant Governor of the Punjab, for the Zoological Gardens at Lahore, where it is at present confined.

C. J. ROBERTSON MILNE, MAJOR, I.M.S.

LAHORE, 17*th June* 1905.

No. V.—A WHITE KÁKAR OR MUNTJAC (*CERVULUS MUNTJAC*).

(*With an Illustration.*)

I am sending you a photograph of a white "Kakar" (*Cervulus muntjac*) which is alive in the palace gardens of His Highness the Maharaja-Dhiraj (King) of Nepal. It is a male and said to be about 4 months old. It has been in confinement for over 2 months and is perfectly healthy and well. It was caught in the hills overlooking the Nepal Valley, in the North.

I do not think it is a true albino because its eyes are dark brown, not pink, and the skin of the nose and face is dark. From the description of this deer in the "Fauna of British India,"—Mammalia, Part II, page 533,– it will be seen that several variations of colouring have been observed.

It may be of interest to naturalists to know that in a large collection of paintings of animals and birds now in the possession of His Excellency Sir Chandra Shamsher Jang, K.C.S.I., Bahadur Rana, the Prime Minister of Nepal, which was made by his famous ancestor Sir Jang Bahadur, and is said to contain the record of all the beasts and birds either shot by Sir Jang or for him by his shikaris, there are pictures of 5 distinct and differently coloured "Kákar," *viz.*:—

(1) *Chestnut* with dark points, *i.e.*, muzzle and legs below knee with usual white belly and vent. This is the common colouring.

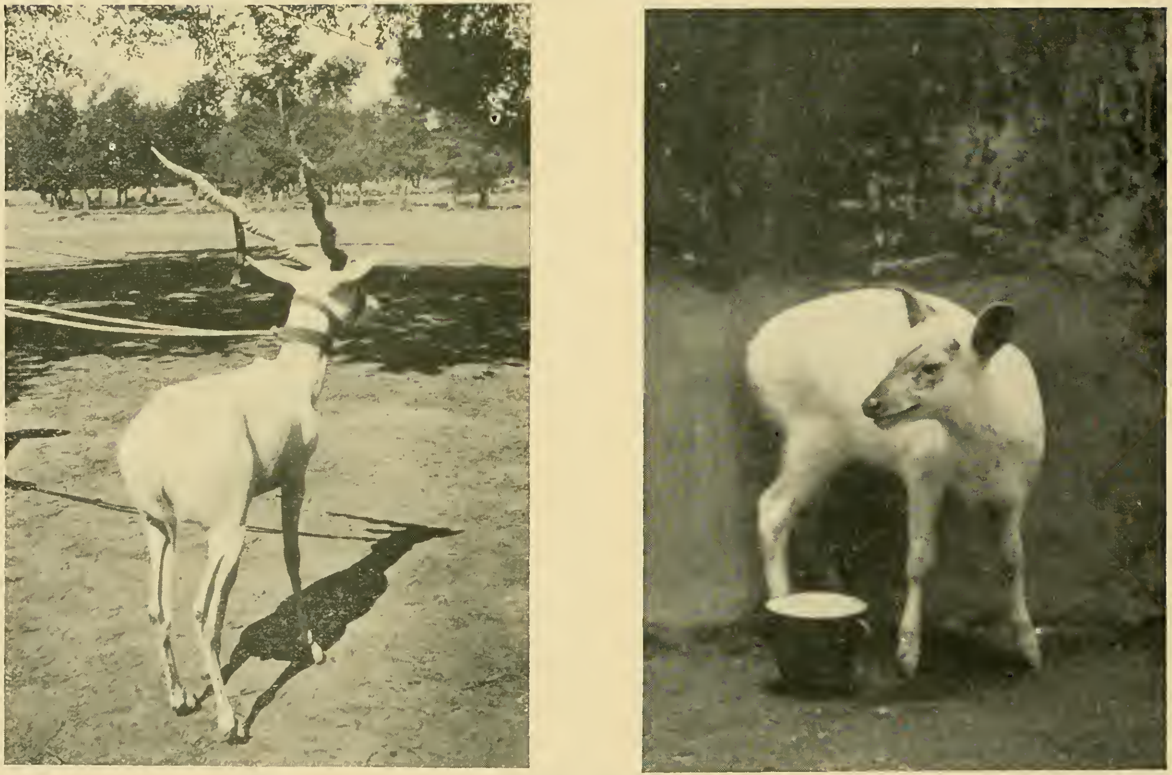
(2) *Chestnut* with light points, white muzzle and legs.

(3) *Light fawn* throughout.

(4) *White* throughout.

(5) *Black* or very dark brown throughout.

I am informed that the white "Kákar" or "Ratwa," as the deer is called here, are uncommon but are constantly occurring, and that several have recently



ALBINISM IN BLACKBUCK AND MUNTJAC.

been seen by the State shikaris. I hope to verify this statement by personal observation during the summer.

J. MANNERS SMITH, MAJOR.

KHATMANDU, NEPAL, 14*th June* 1905.

No. VI.—WILD BOAR WITHOUT TESTES.

Can you give me any information or explanation on a curious subject. We were pigsticking at Vinghool near Ahmedabad on Thursday, 15th June 1905, and killed a very good boar. His measurements were, height from heel to wither 29½″. Tushes 2½″ outside and huge upper tushes. His generative organs were perfect, except there was no sign of testes, or mark or scar where they had been. We cut him open but were unable to find anything at all. The shikaris told me that boars sometimes lost them fighting but there was no scar.

I am also inclined to think that he had not the same fighting pluck as a good boar of his size should have, as he had two opportunities of doing very serious damage but entirely neglected them.

H. E. MEDLICOTT, LIEUT., R.F.A.,
Hony. Secy., Ahmedabad Tent Club.

AHMEDABAD, *June* 17*th*, 1905.

No. VII.—NOTE ON THE BREEDING OF THE KRAIT (*BUNGARUS CŒRULEUS*).

On the morning of the 24th May 1905 while the Public Works coolies were engaged in digging out the old masonry work of the boiler-house behind the Plague Laboratory, they came on a live snake. The snake crawled away, but was at once caught and proved to be a krait, probably one which had escaped from its cage in the Laboratory some time before. Four eggs were found in the earth beside the snake, and later on, while digging further another one was found. Next morning, a sixth egg was unearthed, which being cracked, was opened by me and found to contain an embryo coiled up in a spiral form. It measured about six inches long, and had a reddish appearance reminding one of an earth worm. No scales are to be seen and the head appears disproportionately large. With a magnifying glass, however, the scales appear as circular bosses separated from one another by a space about as broad as their own diameter. One of the eggs was placed in a hole dug in the boiler house, and covered over with earth to see if it would hatch out. It was examined, from time to time, but the shell gradually shrivelled, and the whole became converted into a hard solid lump.

Two of the eggs were put in the cage where the kraits are kept and covered with the sand in the bottom of the cage, but they also have shrivelled up.

The krait an hour after capture became sick, and vomited half a dozen newly born rats.

W. B. BANNERMAN, Lt.-Col., I.M.S.

Plague Research Laboratory, Parel,
Bombay, 27*th June* 1905.

No. VIII.—ADDITIONAL NOTES ON THE BIRDS OF CHITRAL.

Referring to my notes on the birds of Chitral which appeared in No. 1 of this Volume, p. 44-64, I have now to make the following corrections and additions:—

For (610) *Pratincola maura*, the Indian Bush-chat. read (608) *Pratincola caprata*, the Common Pied Bush-Chat.

Add (610) *Pratincola maura*, the Indian Bush-Chat.

I obtained one male only of this species in the Golan Valley in May at 6,000 feet.

Add (638) *Chimarrhornis leucocephalus*, the White-capped Red-start.

Common in summer from elevations of 7,000 feet to 12,000 feet along the banks of streams and rivers.

Add (716) *Tharrhaleus atrigularis*, the Black-throated Accentor.

Only two specimens were obtained in the Bimboret Nallah at 7,000 feet on 27th March.

Add (757) *Propasser grandis*, the Red-mantled Rose-Finch.

Fairly common on the wooded ridges from 7,000 feet to 9,000 feet during the end of April and the beginning of May.

Add (800) *Emberiza luteola*, the Red-headed Bunting.

Arrives on its northward migration towards the end of March.

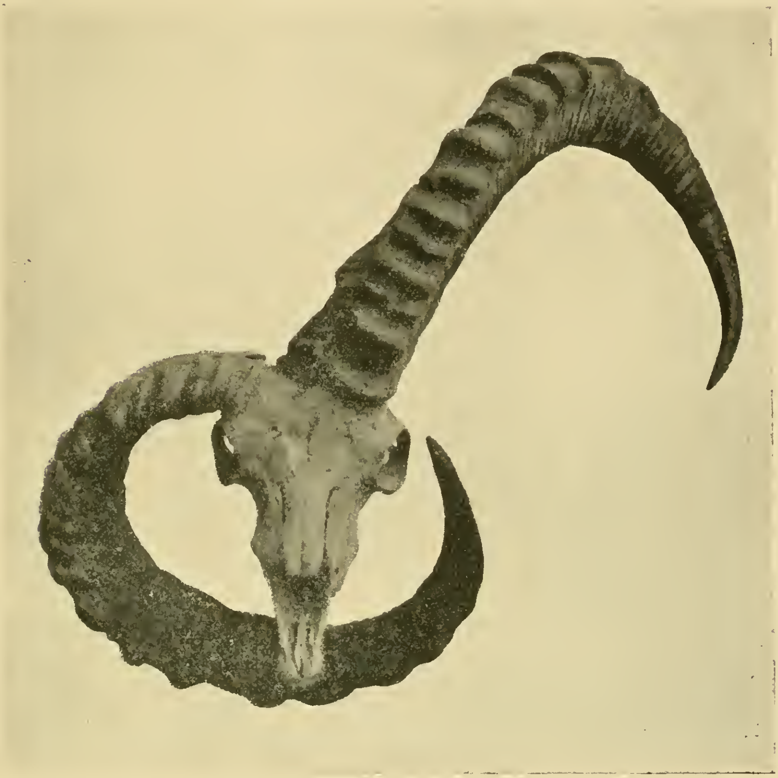
H. T. FULTON, Capt.

Fategarh, *July* 1905.

No. IX.—NOTE ON A CURIOUSLY MALFORMED HEAD OF HIMALAYAN IBEX (*CAPRA SIBIRICA*).

(*With an Illustration.*)

The head was found by one of my assistants, Mr. Waller Senior, in the bottom of a nullah in Lahaul, about 1892. The animal had evidently died on the higher ground and its body had been brought down among a lot of avalanche debris. On examining it will be seen that the abnormal growth of the right horn has absolutely closed the jaws. The jaw bone has got fractured at the back, but when first brought in, the teeth were absolutely tightly closed. The young animal must have had a hit on the horn which started the crooked growth and as it grew, it gradually closed the jaws, till finally the beast died of starvation. What is so remarkable is that the creature lived till the jaws were close shut. The growth of such a horn must be a slow one so that for some years the animal must have been able to support life with the very smallest motion of the jaws. It will be seen that the lower jaw where it rests on the horn is slightly worn away.



There is a further abnormal growth in the shape of the remains of a small additional horn attached to the left horn. Possibly this grew on account of the disturbance to the system caused. by the accident to the right horn.

I am glad that the curiosity will find a safe abiding place in the Society's collection.

ST. GEORGE GORE, Col., R.E.

London, *7th June*, 1905.

No. X—A POSSIBLE CASE OF HYBRID BREEDING OF SHRIKES.

Yesterday I disturbed a *Lanius erythronotus* (The Rufous-backed Shrike) from its nest, which appeared to me at the time to be far more like that of *L. vittatus* (The Bay-backed Shrike). I climbed to it, and whilst at the nest the bird returned and also a *Lanius vittatus* (The Bay-backed Shrike), both coming on to the tree in which I was, and loudly proclaiming their excitement. The nest contained only three eggs all of which were well-set. I have no means of measuring these eggs at the house where I am staying for the present, but hope to send you dimensions later. They appear to me to be somewhat larger than all the eggs of *L. vittatus* I have seen.

ARUNDEL BEGBIE, Major,
16th Rajputs.

Cawnpore, 16*th July* 1905.

No. XI.—THE EGG-LAYING OF *EUDYNAMIS HONORATA* (THE INDIAN KOEL).

I have never found more than two eggs, or young, of the *Eudynamis honorata* in any one nest until this year, when that number has twice been exceeded. The first occasion—30th May—I took four of these eggs and two of *Corvus splendens* (The Indian House-Crow) from the nest of the latter made in quite a young mango tree at the roadside close to the Native Infantry Hospital, Cawnpore.

The next instance struck me as being so extraordinary that I write this note to find out if it is so or not. On the 12th July, in a mango tree right out in the country—some ten miles from Cawnpore, my climber in my presence, took from the nest of *Corvus splendens* (The Indian House-Crow) one fresh egg belonging to the crow and no less than eight eggs of the Koel. These were considerably varied in size, shape and colour, three were fresh, and five set in varying degree. The crow was on the nest when my man climbed up, and while he was at it the male Koel appeared on the scene and flew round and round him at very close quarters, evidently in great excitement.

In this connection I may add that my servants on whom I can depend, informed me on one occasion this year that they had seen a Koel slip into a crow's nest in a tall *Millingtonia* tree near my well, and throw out a crow's egg which they showed me in the shape of a shell-sprinkled patch on the ground.

ARUNDEL BEGBIE, Major,
16th Rajputs.

Cawnpore, 16*th July* 1905.

[This was probably an instance of several koels laying in the same crow's nest.—Ed.]

No. XII.—BREEDING SEASONS OF BIG GAME.

The Brown Bear (*URSUS ARCTUS*).

In No. 2, Vol. XVI, of the Journal, page 384, (Miscellaneous Note XXI,) Major Burton, with reference to bears, puts the question, " But could they have been born during hibernation ?" With reference to the Russian brown bear, at any rate, I can answer, Yes !

Some years ago, in Russia I obtained three little bears not more than two or three days old. I have not here a note of the exact date, but I believe it to have been the 11th of January, and in any case it was during the first half of the month. We turned the mother out of her "Berloga,"—she was very unwilling to leave—and there lay three little cubs, which I took but failed to rear.

I understood from the peasants that winter was the usual breeding season.

D. B. THOMSON, MAJOR, I.A.
(Retired).

LONDON, 11*th July* 1905.

No. XIII.—FOOD OF PREDACEOUS FLIES.

I send a box with several large flies and shall be glad if you can tell me what they are?

Last night after heavy rain there was a large flight of flying ants at about 9-30 p.m. After the swarm appeared we heard a loud humming noise and went out into the verandah to see what it was and found these flies in swarms. We at first thought from the noise, until we caught some, that it was bees swarming, although it was so late at night. We found these flies were hunting the flying ants, regularly hawking at them in the air. When a fly seized an ant it proceeded to devour the soft hind quarters.

This swarm was noted all over our quarters: every house our Officers were present in at that time reported them.

We none of us have ever come across a case like this during our service in the country, and would be obliged if you could give us any information on the subject.

K. E. NANGLE, CAPTAIN,
96th Berar Infantry.

TARBUND, SECUNDERABAD,
18*th July* 1905.

No. XIV.—NOTES ON BIRDS' NESTING ROUND QUETTA.

My lines are now cast in Quetta, which from a birds' nesting view, suits me. I have been enabled to add several new species to my collection, amongst which are some not mentioned by Oates in his "Nests and Eggs."

Before proceeding further, I must acknowledge the great assistance I have obtained from the "Notes on Birds near Quetta," contributed to our Journal, Vol. XIV, by Captain T. E. Marshall, R.A.

For the benefit of any of our readers, who may not know, I would explain that Quetta is situated in Baluchistan, on the N.-W. Frontier and not far from the Afghan border. The country is excessively bare, consisting of considerable sized valleys, over which rugged hills keep watch. Here and there a few oases and green places occur, where some trees may grow, but the general aspect is barren, with next to no vegetation, save scrub. Quetta itself lies some 5,500 feet above sea level, while the surrounding hills may be anything from 7 to 11,000 feet.

The winter is very severe, snow lying on all the hills and falling in Quetta. It also freezes hard. Spring and autumn are delightful. The summer is cool compared with India, but the sun strikes one as uncommonly hot. Spring is the breeding season. In a spot such as this, with so varied a climate, it can be readily understood that nearly all the birds are migratory. Some come here to breed, others to winter.

As I did not arrive here till the end of March, the commencement of the season, I was considerably handicapped both by having to settle in and to learn the country and haunts of the birds. I hope next year to be in a better position to do more.

Coccothraustes humii (HUME'S HAWFINCH). I have found this bird very common since I have been here, but I cannot say whether it winters. The first nest I found was on the 24th April 1905. It was placed in the stoutish fork of a small tree against a small stone, which had somehow got wedged in, and was about 10 feet from the ground. The exterior of the nest consisted of bents, grass, small twigs and sticks, rather flimsy, the interior being lined with cotton, wool hair, etc., welded together, almost to the consistency of felt, forming a compact, deepish cup. It contained 5 fresh eggs of a very light Cambridge blue, thinly speckled or spotted with blackish and dark brown spots. When fresh, the yolk can be seen distinctly through the shell, which gives the eggs an opalescent tinge. When blown the blue is deeper. After this I found several more nests similarly situated usually in *roadside* trees, where they are easily seen, no attempt being made at concealment. The nests are rarely placed beyond hand reach. Five seems to be the complement, though on one occasion I obtained six eggs from one nest. The bird being so common here, it seems curious that it has never been found nesting before, or rather reported.

Galerita cristata (THE CRESTED LARK). Very plentiful here. On the 26th April 1905, I found my first nest, after this I came on many. The birds seem to coop out a hollow first, which they afterwards line with roots, grass, hair, etc., the situation selected is very similar to those of all larks, *viz.,* in a tussock of grass, at the foot of a shrub, etc. In order to deceive one and lure one away from their nests, they sometimes feign being wounded and flutter on the ground before one. Four is the complement of eggs though I have taken five in one clutch.

Saxicola isabellina (THE ISABELLINE CHAT). Plentiful and most obtrusive round Quetta in the spring. This pretty little bird forces itself on one's notice by its antics when love-making. The male becomes ecstatic. He rises in the air a short distance, droops his wings, arches his back, spreads his tail, displaying a large white patch over the rump and then flutters slowly to the ground, uttering a most peculiar love song and alighting on a site usually raised above its surroundings. I spent many an hour watching them before meeting with success. They nest down, what look like, rat-holes, there is nothing to indicate which hole may contain a nest, consequently they are difficult to find unless while actually building, as they seem uncommonly wary and possessed of much patience, that is no matter how long you may wait, they will not enter their homes. However on the 7th May I found two nests. One contained young which I did not open, as it was useless. The other contained 5 hard set light blue eggs, which have made bad specimens. In the one I did not open, I got 5 hard set eggs on the 2nd June, from this I infer they have two or more broods a year, utilizing the same nests. On digging up one or two nests, I found that off the main channel, there were 3 or 4 passages, at the end of one would be the nest placed in an enlarged chamber ; whether the male uses the others I do not know. They do not appear to object to lodgers, as out of one of the side passages I turned out two toads and a dung beetle ! The nest is a pad of hair, wool, cotton, feathers and any soft material, in the middle of which is a depression for the eggs. The nest contains very much the same material as that of the tit. I hope next year to meet with considerable success as the bird is so numerous.

Hirundo rustica (THE SWALLOW). Very common in spring and summer. Builds freely in houses, mostly those of natives, who do not like them being molested. I got two nests on 6th and 23rd May 1905, with 4 fresh eggs each.

Merops apiaster (THE EUROPEAN BEE EATER). I noticed these birds first in April haunting the railway line and sitting along the telegraph wires.

Provided they remained, I was sure they would breed. At this time I noticed several holes which looked much like those they nest in. The first nest I opened on the 10th May : as it only contained two fresh eggs, I waited till the 14th idem, when I obtained 5, each containing 6 eggs, some fresh, others in different stages of incubation. On the 15th I took two more, one with 6 incubated and the other 2 fresh eggs. After this I did not trouble about them. The nest holes were excavated in steep perpendicular banks, the passage being opened up into a chamber at the end, in which were strewn countless remains of beetles and winged insects on which the eggs were laid or rather embedded. I took out hands full of this debris. One fact I noted was that, in every instance but one, the nest faced to the east, although equally suitable banks facing west were available. I think this may be to ensure coolness. The sun becomes peculiarly hot here during the day, and towards the afternoon when it is declining to the west, it is well nigh unbearable. I can think of no other reason. The best method to dig out the nests is to place a thin cane in the passage : this indicates the line to be followed, which it is very necessary to know as they are from 5 to 6 feet in depth. In nearly every instance the female was on the nest, but I always let them out. In one instance I caught one which was buried in the passage : she had evidently been trying to escape. After examination I let her go.

Hypolais rama (SYKES' TREE-WARBLER). Mr. Doig found this bird breeding in Sind, so it is not surprising to find it here. It seems common in the spring, showing a partiality for the shade and coolness of lucerne fields. On the 10th May I came on several nearly completed nests, and on the 14th took some 14 containing 4 fresh eggs each, except in one or two instances when there were 5. The breeding ground was a field of lucerne hedged round by thick rose bushes, in the forks of which the nests were situated and although well concealed by the thick foliage, by parting this the nests are easily seen. These are compact cup-shaped little structures, consisting of sticks, grass, roots and fibres, warmly lined with wool, hair and such like soft material, while a few contained feathers. I found most of the nests in the rose hedges on the northern and southern borders ; this, I think, is due to the fact that the eastern and western run parallel and close to a railway and road respectively, and are consequently more liable to disturbance. After this haul I took no more.

Saxicola picata (THE PIED CHAT). Fairly common I only succeeded in finding two or three nests late in May and early in June with young. The nesting sites and nests are very similar to those selected by the Indian Black and Brown-backed Robins (*Thamnobia fulicata* and *cambaiensis*), *viz.*, in holes in walls, under the eaves of houses and among rafters. I thought I was sure to come on many, so did not bother about them. I shall pay them more attention next year.

Pratincola caprata (THE COMMON PIED BUSH-CHAT) is quite common, but as I have obtained their eggs in India, I have not troubled over them, although I have come on a nest or two.

Anthus similis (THE BROWN ROCK-PIPIT). This bird seems common at the foot of the hills round Quetta. On the 13th July I found two nests, one situated in a small bush, well built and concealed, very lark-like, which contained 3 eggs just hatching, the other was rather untidy, built under a projecting rock, with no cover. This was being built, so I hoped to get a good clutch. On visiting it a week later, to my disappointment I found it deserted. I hope to do better next year.

Lanius erythronotus (THE RUFOUS-BACKED SHRIKE) is common and breeds freely, but as I have their eggs, I have not troubled over them.

Passer montanus (THE TREE-SPARROW). Common and breeds. Habits similar to those of the common sparrow.

About the middle of May I noticed large flights of the ROSE-COLOURED STARLING (*Pastor roseus*), better known as the 'Jowari Bird,' winging their way West, morning and afternoon ; during the day they appeared to rest. I never saw one flight going East. I have seen a few stragglers about lately, but I am watching curiously to see whether they will return to India by this route, and when.

R. M. BETHAM, MAJOR,
The 101st Grenadiers.

QUETTA *3rd August* 1905.

No. XV.—WILD DOGS HUNTING.

I shot a wild dog (*Cyon dukhunensis*) the other day. I had just before shot a black bear and was waiting on a ridge for another small ravine to be beaten up to me, when I heard a pack of dogs on the ridge of the nala behind me giving tongue—a sort of yapping bark. I cannot say that they were in full cry, but they were evidently hunting, probaby after "Thar" (The Himalayan Goat-antelope or Serow) or "Kakar" (The rib-faced or barking Deer), marks of which I had seen on that hill the day before. As regards the question of the wild dog giving tongue when hunting (see page 145, "Fauna of British India," Mammalia) I should say they might 'open' when they first strike a trail to collect the pack and thereafter run 'mute' till in view. I certainly should not have seen the dogs unless I had heard them two or three times, as my back was turned and my attention in another direction, and it was the second or third time they gave tongue before I saw where they were working through the bamboo jungle and trees on the opposite hill.

J. MANNERS SMITH, MAJOR.

NEPAL, *July 28th*, 1905.

No. XVI—FOOD OF THE "MUSKRAT" OR THE GREY SHREW (*CROCIDURA CŒRULEA*).

Lately we have been troubled by having our young guinea pig sucklings eaten by rats.

By careful watching the depredator has been found to be the "Heavenly Shrew," hitherto considered a harmless insect feeder.

The method of procedure was for the shrew to get under the cage and to attack the young ones through the meshes of the wire-netting bottom. In this way the legs were eaten off and even the inside cleaned out of the little beast, sometimes little being left but the skin. A shrew has twice been caught in the act, and we have lost between 20 and 30 guinea pigs in this way lately.

The available literature on the subject certifies to the fact that the usual food of the muskrat is cockroaches and other insects, but a few instances of other victuals being eaten are recorded.

Thus Sterndale in the Mammalia of India quotes a correspondent of *The Asian* from Ceylon who gives an account of a Muskrat attacking a large frog, and holding on to it in spite of interference.

He also quotes McMaster as certifying that these shrews eat bread, and as having disturbed one evidently eating part of a large scorpion.

Blanford ("Fauna of British India," Mammalia) says that "the food of this shrew consists mainly of insects, but meat is occasionally eaten by it." He also adds that it has been accused of eating rice and pulse, but experiments by Anderson disprove this.

Notes on the food of the Muskrat will be found in our Journal, Vol. X, p. 330, and Vol. XIII, p. 699.

The first note is by Mr. Wasey from Marmagao, describing the capture of a bull-frog. He notices the eagerness of the shrew to recapture the frog when separated, and the ultimate removal of its dead victim.

The second note is written by Major Frall, I.M S., and describes the finding of a toad, under the steps of the Residency at Baroda, in the grip of a muskrat.

The shrew had it between the eyes and was holding on like a bull-terrier.

The remains of other toads were found in the same place.

It would appear therefore that occasionally the shrew departs from his diet of insects, and takes to flesh eating.

W. B. BANNERMAN, Lt.-Col., I.M.S.

Plague Research Laboratory,
Parel, *7th August*, 1905.

No. XVII.—DOUBLE-HEADED SNAKES.

With reference to a note on Double Headed Snakes contributed by me to this Journal (Vol. XVI, p. 387), I have just acquired a very interesting paper on this subject which appeared in the Transactions of the Wisconsin Academy of Sciences, Arts and Letters (Vol. XIII, Part II, 1901) by Mr. R. H. Johnson. The writer gives skiagrams of 13 specimens collected from various museums in America, and refers to 17 other instances of this abnormality culled from literature dating as far back as 1640.

As the magazine in which this appears probably does not come under the notice of the majority of our readers, a few excerpts from this very complete paper will doubtless prove interesting.

In all the 30 cases the cephalic extremity was reduplicated, and in 3 of these the caudal end was also bifurcate.

Three examples occurred in individuals of the same brood recorded by Mitchill in 1826, and 2 of these were reduplicated posteriorly.

The vertebral division, judging from the skiagrams, is always considerably more extensive than is indicated by the cutaneous attachment, and this was the case in the Fyzabad specimen I recorded.

In 3 of the 13 specimens the skulls were confluent posteriorly, and in the rest the heads and necks were distinct Separate heads and necks are also the rule in the other cases cited, but figures cannot be quoted owing to some of the descriptions being insufficient. In 2 of the 3 examples with confluent skulls, the apposed parietal shields are blended into one, but in the third this point is not manifest. In 3 of the 13 specimens the skulls are malformed, the lower jaw or eyes or both being deficient.

In 2 of the 13 there is an angular vertebral projection as in the Fyzabad specimen, but the skiagrams show that this projection does not occur at the exact site of the vertebral blending, but at some little distance behind

The most extensive reduplication of the 13 shows 67 cervical vertebræ on one side and 72 on the other, but the specimen recorded by Redi in 1684 is bifid to the middle of the back, and in this there are two œsophagi, lungs, stomachs, hearts, and livers.

The most remarkable specimen, however, is that recorded by Wyman in 1863 in which both cephalic and caudal extremities are double, and there are two vertebral columns provided each with their distinct sets of ribs and organs.

Only 4 of the 13 specimens Mr. Johnson examined are recorded as embryos or young.

F. WALL, C.M.Z.S.,
CAPTAIN, I. M. S.

MUSSOORIE, 21*st August*, 1905.

No. XVIII.—ACCIDENT TO THE YOUNG OF THE INDIAN CLIFF-SWALLOW (*HIRUNDO FLUVICOLA*).

I see in the last issue of the Society's Journal a note by Major Begbie stating his discovery of dead young birds in the nests of *Hirundo fluvicola* (The Indian Cliff-Swallow). It may be of interest to him and to others to know that I found the same thing on the Nerbudda River on April 9th, this year. The dead birds were fully fledged or nearly so, and consisted of bones and feathers. I saw no maggots as Major Begbie did, but very likely they had been eaten in the same way. I saw 15 or 20 young birds in this state in the whole colony of 80 to 100 nests.

MARTIN YOUNG, M.B.O.U.
(1st York and Lanc. Regiment).

MHOW, C. I., 20*th August*, 1905.

No. XIX.—LADY AMHERST'S PHEASANT IN BURMA—A CORRECTION.

Since writing my note on the occurrence of Lady Amherst's Pheasant (*Chrysolophus amherstiæ*) in Burma that appeared on p. 512 of this Volume, Mr. E. W. Oates has drawn my attention to a previous record of it that he referred to in the appendix to the second part of his "Manual of the Game Birds of India." Therein he wrote, p. 497: "Quite recently a male specimen of this species was obtained on the Burmo-Chinese frontier by one of the officers attached to the Boundary Delimitation Commission. This bird was forwarded to Mr. Rowland Ward, who sent it to the Museum of Natural History for inspection, and thus it came to my knowledge. I understand that it was shot on the frontier either in the Myitkyina or the Bhamo District."

Although this somewhat indefinite record was sufficient to establish this pheasant as an "Indian" bird, the detailed record of the specimen obtained by Lieutenant Van Someren is none the less interesting.

E. COMBER, F.Z.S.

BOMBAY, 4*th September*, 1905.

No. XX.—SHOOTING NOTES FROM THE CENTRAL PROVINCES.

I send you the following extracts from my diary kept while shooting in the Central Provinces during last April and May.

1. While strolling in the jungle about sunset I was attracted by monkeys "swearing." On going towards the sound I came on an old monkey (Langoor) just killed by a panther. The panther slipped into a nullah before I could get a shot. An old Korkoo shikari told me he had seen a panther catch a monkey in a tree, the panther holding on to the branches by one fore paw as he did so, and then hauling the monkey up.

The monkeys which had attracted my attention to the panther, left off swearing when I came up and went quietly away.

2. While walking down the bank of a stream one evening looking for tiger pugs I noticed the smell of a dead animal close to me. Following up the smell I came on a tiger cub which had apparently been dead three or four days. It seemed to be about five months old. The body was hidden in long grass and covered with loose grass which looked as if it had been cut with a sharp implement. I then wandered down the stream, and within about sixty yards came on the perfectly fresh marks of a tigress (by the pugs) ; she had apparently only moved off while we were looking at the dead cub. The tracks were still wet where she had gone out of the stream. The body of the cub was too decomposed to see if it had been injured.

3. Some four miles from the place referred to above, I came on a regular tiger lair with the hair of a black bear spread all over the place. The bear had evidently found a meal for a tiger or tigers.

4. A large tigress and cubs lived near this place at the time of my visit. I tied up for them, and had a buffalo killed one night. On our way to the kill early next morning we tracked the tigress on a jungle road for a long way, then lost the tracks for a hundred yards or so and came on them again. Looking round where the tracks left the road we saw a large stag sambhur (in velvet) lying dead under a mhowra tree, and evidently freshly killed. The tigress had apparently seen the sambhur from the road feeding on the fallen berries, had turned off to kill him and then gone on without eating any of the flesh. Probably she had previously killed my buffalo. There were several marks on one hind leg about the hock where she had apparently first caught the sambhur with teeth and claws but the leg was not broken ; there were also the usual teeth marks on the neck. The tigress was a large one, she measured eight feet nine inches round the curves and sixteen inches round the forearm. This may prove of interest in connection with the notes from Burma on tigers hamstringing their prey before killing which appeared in the last volume of the Society's Journal.

5. I came across a panther one evening, but could not get a shot. We tied up a buffalo that night and he killed it. I had intended sitting up for him behind a screen of bushes and grass, but circumstances prevented me. The night I should have sat up, a large male tiger carried off the panther's kill

about three hundred yards and ate it. Another night the same tiger carried off and ate a buffalo which I had tied up for him the night before, but which unfortunately had fallen over its rope and strangled itself. I found the buffalo in the morning just dead and absolutely untouched by any animal, nor could we see any tracks of an animal near it. We covered the carcase with grass for the day and uncovered it in the evening. The tiger came that night, broke a very strong rope, dragged the buffalo away about a hundred and fifty yards, and ate a good deal of it. The panther left the jungle after the big tiger came. At any rate we could find no trace of him.

F. W. CATON JONES, Lieut.-Col., R.A M.C.

Nasirabad, Rajputana, *August* 21*st*, 1905.

No. XXI.—NOTES FROM NEPAL.

(1) On the 3rd of August this year a tigress, which was born here in June 1895 and had been kept with another tiger of the same litter, gave birth to 4 cubs. The tiger resented the appearance of his family and devoured one of the cubs, but was then separated and placed in another den. Since then the tigress and three remaining cubs have done well. This is the first time this pair of tigers have bred here.

(2) A pair of ostriches belonging to His Excellency Sir Chandra Samsher Jang, G. S. S. I., Prime Minister of Nepal, have also this year reared a brood. Ostriches have been kept in Nepal for a number of years past, but though eggs have been freely laid, no further progress in propagating the species has resulted. His Excellency, however, took a personal interest in the matter and caused a large bed of sand to be made in the enclosure in which the birds are kept. The female began to lay in February and on the 25th the tenth egg was left to see if they would sit ; nine more eggs were laid, and the male bird took over the duty of incubation, the female keeping on the alert as if on guard. Three eggs were hatched on the 2nd of May, four on the 3rd, and three on the 5th of May.

Unfortunately a heavy storm accompanied by furious rain drowned or otherwise did to death 3 of the chicks The rest have thrived splendidly and are now strong healthy birds well over 3 feet high. The ostriches are fed on pieces of cabbage chopped up, gram, wheat and rice, and are given plenty of sand which they swallow freely with their food. It is a peculiar habit in these birds that as soon the parents discharge any droppings, the young birds run up and swallow them.

(3) In June a young Magpie Robin (*Copsychus saularis*), one of two we were bringing up by hand, was killed in a strange way. The two little birds were sitting out on a patch of grass in the open, having been let out of their cage to feed, when a swallow made a sudden swoop and struck one of them a fierce blow on the head, from which it succumbed shortly after.

J. MANNERS SMITH, Major.

Khatmandu, Nepal, 1*st September*, 1905.

No. XXII.—TIGERS HAMSTRINGING THEIR PREY BEFORE KILLING.

With regard to Mr. C. W. Allan's note and query on the above subject, in Vol XVI, No. 3 of our Journal, I may state that I have myself noticed and have also been told by herdsmen, that when attacking a camel, a tiger invariably hamstrings it first by seizing its hind legs. As soon as the animal is down, however, he makes for its throat and kills it in the usual way, before drinking its blood. This practice first came to my notice in the Danta State, North Guzerat. I have seen the remains of a good many cows and buffaloes killed by tigers in the same district, but it is only in the case of *camels* that I have found hamstringing resorted to, for the simple reason, I imagine, that the latter's throat is difficult to reach, when it is standing up, probably grazing.

L. L. FENTON, Lieut.-Colonel.

Kashmir, *2nd September*, 1905.

No. XXIII.—CURIOUS END OF A DRAGONFLY.

A few days ago my attention having been drawn, by my dog, to a large dragonfly struggling on the ground in front of my tent, I went to examine it, thinking my dog must have in some way or other injured it, but I was surprised to find, on close examination, that it was in the clutches of a hornet which had hold of the upper part of its body and seemed to be stinging it all over the latter as fast as it was able to do so. The dragonfly was quite powerless in the hands of its enemy and could only flutter on the ground. On my touching the hornet several times with a small piece of stick, it very reluctantly left its prey and flew right away. The dragonfly was, however, quite done for and unable to fly away or even move from where it was lying. I left it where it was, to see if the hornet would return. This it did in a few minutes and at once alighted on the dragonfly. Having evidently satisfied itself that it was quite crippled, it deliberately set to work to cut up the body with its sharp nippers. In less than a minute it had amputated about 1½ inches of the tail-end of the body, with which it flew off, but where, I was unable to ascertain. It returned again, and while engaged in amputating another part of the unfortunate dragonfly's body I captured it and placed it in a box with the now defunct dragonfly for future examination. I am aware that hornets are very fond of carrion, but had no idea before that they preyed upon insects of any kind. How the hornet had captured the dragonfly I have no idea, but quite possibly on the wing or when seated.

L. L. FENTON, Lieut.-Colonel.

Kashmir, *2nd September*, 1905.

No. XXIV.—TIGERS HAMSTRINGING THEIR PREY BEFORE KILLING.

During the hot and cold seasons of 1904-05 I know of half a dozen domestic buffaloes used in timber work being hamstrung. Since the animals were in no case killed, I put this down to panthers, but after seeing Mr. C. W. Allan's note on this subject on page 499 of the last number of the Journal, I have now no doubt that tigers were the cause: as the herder was generally near and drove the buffaloes to shelter.

S. B. BATES, F.Z.S., &c.

Mansi, Kalha District,
U. Burma, 30*th August* 1905.

No. XXV.—A CONGREGATION OF BRAHMINY KITES (*HALIASTUR INDUS*).

Mr. Donald's note in the August issue (No. 3 of Vol. XVI) of the Journal on "A Congregation of Harriers" reminds me of a somewhat similar occurrence which I witnessed on the Pikkili Hills in the Salem District last April. My camp was pitched about 100 yards from the village of Pikkili close to a clump of large tamarind trees and three or four more of the same trees stood together in the middle of the village. On the evening of my arrival just after sunset, I noticed a number of Brahminy Kites flying towards the village and settling on the higher branches of both clumps of trees, and as more were coming in a continuous stream from the same direction, I began to count them. I counted over 300 but they were now arriving so rapidly it was impossible to continue. In about half an hour they had apparently all arrived and in that time at least 300 more must have come. They were quite silent but very restless until it was quite dark. A good many birds were in immature plumage but no other variety of Kite was present.

A couple of Jungle Crows (*Corvus macrorhynchus*) were nesting in one of the trees and the anxiety they displayed when a Kite approached them was very amusing, but they successfully defended from intrusion a space of a dozen yards or so from the nest.

I remained on the spot for three days and the same thing occurred every evening. They had all disappeared before sunrise, but I was never early enough to see them go. I could not ascertain from the villagers, who were a particularly apathetic lot, how long before the kites had first arrived, but the state of the ground below did not suggest a very long period and in all probability the crows were the first tenants of the trees. At any rate the fact is perhaps worth recording that over 600 Brahminy Kites were in the habit of roosting on the same spot night after night.

R. FOULKES.
(Madras Survey).

Coimbatore,
19*th September* 1905.

No. XXVI.—THE FOOD OF KINGFISHERS.

Is it usual for Kingfishers to eat Frogs?

Some time ago I saw one of the larger Kingfishers dive into a stagnant pool and bring up a large frog with which he retired to a neighbouring bough and apparently enjoyed.

S. B. BATES, F.Z.S., &c.

MANSI, KALHA DISTRICT,
W. BURMA,
30th August 1905.

[Kingfishers in this country appear to be almost as omnivorous as toads, and "Eha" on page 46 of his "Common Birds of Bombay" mentions how this white-breasted Kingfisher (*Halcyon smyrnensis*) feeds on frogs, water insects, crabs, &c., and even swallows small birds when kept in an aviary. We have certainly seen them dive on to dry land and capture lizards (*Calotes versicolor*).

EDITORS.]

No. XXVII.—FOOD OF SNAKES IN CAPTIVITY.

On the 9th July last a phoorsa (*Echis carinata*) kept in captivity in our Museum swallowed another phoorsa which was in the same cage. The victim was only slightly smaller than the other viper and the following day as the meal was apparently too large it was disgorged. It is sometimes difficult to obtain sufficient proper food (mice, &c.,) for such small vipers and the cannabilism was probably therefore induced by extreme hunger. About the same date two pythons (*Python molurus*), a 'ghorpad' or Indian Monitor (*Varanus bengalensis*) and four large bull frogs (*Rana tigrina*) were occupants of another cage in the museum and had been living together in peace for some months. As the pythons appeared to be hungry, two rats were introduced. The 'ghorpad' at once seized one rat, shaking it and killing it with the intention of swallowing it. One of the pythons then seized the 'ghorpad' and commenced to crush it. It was considered necessary then to intervene and the lizard was released from the python's coils. The python then moved round the cage and on one of the large frogs making a jump it was seized and crushed. When it was dead but still in the python's coils, the 'ghorpad' seized hold of one of the frog's hind legs and commenced to swallow that. The python then lost all patience and crushed the lizard, swallowed it, the frog and the rat, and afterwards proceeded to kill and swallow another frog.

Whilst trying to crush the lizard and the frog, the python managed to get its own head and neck within its own coils and very nearly killed itself, since it apparently did not like loosening its coils until the 'ghorpad' was dead. However ultimately the python was able to free its own neck and the result was only the above diminution of the 'happy family'.

W. S. MILLARD,
Honorary Secretary,
Bombay Natural History Society.

6, APOLLO STREET,
BOMBAY, *25th September* 1905.

PROCEEDINGS

OF THE MEETING HELD ON 31st AUGUST 1905.

A meeting of the members of the Bombay Natural History Society took place at the Society's rooms on the 31st August 1905, Col. H. D, Olivier, R. E., presiding.

NEW MEMBERS.

The election of the following 21 new members since the last meeting was duly announced :—

Lieut. R. D. O. Hill (Dehra Dun); Mr. W. G. Barnett (Kirkee); Lieut.-Col. W. B. Mullins (Dehra Ismail Khan); Lieut. W. R. B. Douglas, R.I.M. (Bombay); the Hon'ble R. Bruce (Poona); Mr. C. V. Narasiah (Coimbatore); Mr. H. F. Arbuthnot, I.F.S. (Coimbatore); Lieut. M. E. Yeatman (Karachi); the Mess President, 29th Lancers (Sirur, Poona Dist.); Capt. H. M. C. Orr (Trimulgherry); Mr. E. Meyrick, B.A., F.R.S., F.Z.S. (Marlborough College, Wilts); Major F. J. Dewes, I.M.S. (Taunggyi, U. Burma); Mr. S. E. F. Jenkins, I.F.S. (Loilem, U. Burma); Major W. E. Venour (Rawal Pindi); Major G. W. Rawlins (Poona); Mr. L. Graham, I.C.S. (Dharwar); Mr. M. Webb, I.C.S. (Dharwar); Mr. Wm. Vaughan (Ceylon); Major J. Jackson, I.M.S. (Poona); Capt. H. W. Berthon (Sawant Wadi) and Capt. R. B. B. Foster, I.M.S. (Secunderabad).

CONTRIBUTIONS TO THE MUSEUM.

Mr. W. S. Millard, the Honorary Secretary, acknowledged receipt of the following contributions since the last meeting :—

Contributions.	Descriptions.	Contributors.
1 Crow's nest made of wire and metal.	*Corvus splendens*	Mr F E. Otto.
1 Sea Snake	*Hydrus platurus*	Mr. F. C. Annesley.
1 Snake	*Lycodon aulicus*	Hon. A. E. Hill-Trevor.
1 Snake and 9 birds	....	Mr. S. St. C. Lightfoot.
Some Snakes and a number of Insects from Lakhimpur, Assam.	....	Mr. P. H. Clutterbuck, I. F. S., F. Z. S.
1 Large Fungus	*Botelus genus*	Col. K.R. Kirtikar, I.M.S.
1 Lizard	*Eublepharis sp.*	Mr. S. W. Coxon.
3 Sea Snakes	*Hydrus platurus*	Capt. F. Wall, I. M. S.
1 Sea Snake	*Hydrophis cærulescens*	
2 Sea Snakes	*Hydrophis fasciatis*	
3 Sea Snakes	*Hydrophis gracilis*	
1 Sea Snake	*Hydrophis cantoris*	
1 Sea Snake	*Enhydrina valakadien*	
2 Sea Snakes	*Distira jerdonii*	
5 Sea Snakes	*Distira cyanocincta*	
4 Sea Snakes	*Distira brugmansii*	
1 Sea Snake	*Distira Gillespiæ*	
1 Sea Snake	*Distira viperina*	
1 Sea Snake	....	
1 Sea Snake	*Enhydris curtus*	

Contributions.	Descriptions.	Contributors.
1 Sea Snake Skin (13 feet 8 in.)	*Python molurus*	Mr. H. Devlin.
4 Ants Nests from Khandalla	*Pheidole sykesii*	Mr. W. S. Millard.
1 Head of Tibetan Gazelle from Umballa.	*Gazella picticaudata* ...	....
1 Pheasant-tailed Jacana.	*Hydrophasianus chirrurgus*	Lt. R. G. Beatty.
3 Eggs of the Grey Wagtail.	*Motacilla melanope*	Col. A. E. Ward
Eggs of the Eastern Meadow Bunting.	*Emberiza stracheyi*	
2 Eggs of the Indian Turtle Dove.	*Turtur ferrago*	
1 Himalayan Snow-cock.	*Tetrogallus himalayensis* ...	
1 Snow Partridge ...	*Lerwa nivicola*	Mr. E. M. Rennell.
1 Snake	*Coluber helena*	Capt. J. Oxley, I.M.S
1 Bandicoot-rat	*Nesocia bandicota*	Capt. W. G Liston, I.M.S.
2 Blue-breasted Quails ...	*Excalfactoria chinensis* ...	Major J. Elgee.
5 Eggs of the Jackdaw ...	*Corvus monedula*	Col. A. E. Ward.
4 Eggs of the Indian Bush-chat.	*Pratincola maura*	
1 Fish	*Siluroid sp.*	Mr. J. Mason
133 Terns Eggs from the Persian Gulf.	....	Lt. L. F. Philbrick, R.I.M.

Minor contributions from Col. W. B. Ferris, Mr. E. W. Trotter, Mr. G. Nelmes, Mr. R. R. Wright, Col. W. B. Bannerman, I.M.S., and Mr. Sunderrao Dinanath Navalkar.

CONTRIBUTIONS TO THE LIBRARY.

Trevandrum Museum Report for 1903-4 ; Lepidoptera Indica by Moore, Vol. VI, Part LXXI , from H. H. the Maharaja of Mysore ; Bulletin of the U. S. National Museum No. 50 (the Birds of North and Middle America, Part III) and Aquila (A Magyar Ornithological Kospont folyoirata), from the Smithsonian Institution ; Nature-History Museum by Nasarvanji Jivanji Readymoney, from the Author ; Journal and Proceedings of the Asiatic Society of Bengal, Vol. I, Nos. 1 and 2, 1905 ; and Journal of the Asiatic Society of Bengal, Vol. LXXIII, Part II, 1904, in exchange ; A Note upon the "Bee-Hole" Borer of Teak in Burma, by E. P. Stebbing, F. L. S., from the Author.

PAPERS READ.

The following papers were then read :—1. Some Bombay Orthoptera (Earwigs, Cockroaches, Locusts, Grasshoppers, Mantises and Crickets), by L. C. H. Young, B. A., F.E.S., F.Z.S. 2. Notes on Rhinoceroses in Burma, by Vety.-Major G. H. Evans. 3. The Culicid Fauna of the Aden Hinterland, their haunts and habits, by Lt. W. S. Patton, I.M.S. 4. Descriptions of Indian

Micro-Lepidoptera, by E. Meyrick, B.A., F.R.S., F.Z.S. 5. The Mangrove of the Bombay Presidency and its biology, by the Revd. E. Blatter, S.J. 6. Albinism in the Blackbuck, by Major C. J. Robertson Milne, I.M.S. 7. Note on the Breeding of the Krait, by Col. W. B. Bannerman, I.M.S. 8. Food of the 'Muskrat,' by Col. W. B. Bannerman, I.M.S.

A vote of thanks was passed to the authors of the various papers, and the meeting then terminated.

PROCEEDINGS

OF THE MEETING HELD ON THE 5TH OCTOBER 1905.

A meeting of the members of the Bombay Natural History Society took place at the Society's Rooms on the 5th October 1905, Lieut.-Colonel W. B. Bannerman, I.M.S., presiding.

NEW MEMBERS.

The election of the following nine new members, since the last meeting was duly announced:—

Mr. J. R. Spence (Bombay); Capt. R. B. B. Foster, I.M.S. (Secunderabad); Lieut. O. Harris, R.H.A. (Rawalpindi); Col. G. F. N. Tinley (Meerut); Mr. W. Harvey Jones (Bombay); Capt. G. H. Stewart, I.M.S. (Falam, Chin Hills, Burma); Mr. J. T. Fry (Parel); and Major C. R. Hoskyn, R.E. (Bombay).

CONTRIBUTIONS TO THE MUSEUM.

Mr. W. S. Millard, the Honorary Secretary, acknowledged receipt of the following contributions since the last meeting:—

Contribution.	Description.	Contributor.
1 Barn Owl	*Strix flammea*	Mr. H. M. Whittell.
1 Montagu's Harrier	*Circus cineraceus*	"
1 Common Indian Swift.	*Cypselus affinis*	"
1 Purple Sun-bird	*Arechnechthra asiatica*	"
1 Glossy Ibis	*Plegadis falcinellus*	Mr. H. A. Huagrath.
1 Great Eastern Horseshoe-bat.	*Rhinolophus luectus*	Major J. Manners Smith.
A collection of Estuary Fish from Alibag.	1 *Lates calcarifer*	Mr. W. A. Wallinger, I.F.S.
	1 *Polynemus plebius*	
	1 *Polynemus tetradactylus.*	
	1 *Serranus gilberti*	
	1 *Chrysophrys datnia*	
	1 *Plotosus canius*	
	1 *Telustei aconthropterygii.*	
	1 *Engraulis taty*	
	1 *Batrachus gangene*	
	1 *Hemirhamphus georgii*	
	1 *Equula brevirostris*	
	1 *Terapon jarbua*	
	1 *Platycephalus scaber*	
	4 *Gobioides sp.*	
	1 *Sillago sihama*	
	1 *Arius falcarius*	
	1 *Belone strongylura*	

Contribution.	Description.	Contributor.
A collection of Estuary Fish from Alibag.	*1 Clupea lile*	Mr. W. A. Wallinger, I.F.S.
	1 Coilia dussumieri	
	1 Engraulis mystax	
	1 Lujanus johnnii	
	1 Trichiurus savala	
	1 Sciæna sina	
	1 Polynemus heptadactylus.	
	1 Mugil œur	
	2 Sciæna carutta	
	1 Scatophagus argus	
	1 Trachanotus russellii	
	1 Caranx nigripinnis	
1 Snake from Dthala, Aden-Hinterland, n. sp.	*Melanelaps mcphersoni*	Captain G. M. McPherson, I.M.S.
1 Brown Tree-Snake (alive).	*Dipsas trigonata*	Mr. M. Young.
4 Persian long-tailed Field Mice.	*Mus arianus*	Col. A. E. Ward.
1 Snake (alive)	*Gongylophis conicus*	Capt. O. A. Smith.
1 Blue-breasted Quail	*Excalfactoria chinensis*	Major J. W. Elgee.
1 Snake juv (alive)	*Zamenis mucosus*	Mr. Narotam Morarji Goculdass.
1 Pit-viper from Kasauli	*Lachesis gramineus*	Capt. F. Wall, I.M.S.
3 Eggs of the Large Egret	*Herodias alba*	Major J. W. Elgee.
3 Eggs of the Smaller Egret	*Herodias intermedia*	„
3 Eggs of the Battle Egret	*Bubulcus coromandus*	„
1 Hodgson's Grandala	*Grandala cœlicolor*	Major H. Delmé-Radcliffe.
1 Red-headed Laughing Thrush.	*Trochalopterum erythrocephalum.*	„ „
1 Snake juv	*Simotes arnensis*	Col. H. J. Waller Barrow, R.A.M.C.
1 Snake juv	*Typhlops porrectus*	„ „
1 Bandicoot-rat	*Nesocia bandicota*	Lieut.-Col. W. Bannerman, I.M.S.

CONTRIBUTIONS TO THE LIBRARY.

Annual Report from Lucknow Museum, *Lepidoptera Indica,* by Moore, Part LXXII, presented by H. H. the Maharaja of Mysore; Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India Nos. 16 and 17, from Captain G. Lamb, I.M.S.

EXHIBIT.

Mr. G. Monteath, I.C.S., exhibited the skin of a black panther shot in Kanara, and raised the question as to whether the tongue is black or not—as Rowland Ward & Co., it would be seen, had made the tongue of this specimen quite black.

PAPERS READ.

The following papers were then read :—

1. A new Himalayan snake (*Lycodon mackinnoni*), by Capt. F. Wall, I.M.S. 2 A new snake (*Melanelaps mcphersoni*) from the Aden-Hinterland, by Capt. F. Wall, I.M.S. 3. Some of the indigenous and exotic fruits and vegetables obtainable in Bombay, by Lieut.-Col. K. R. Kirtikar, I.M.S. (retired).

The Society exhibited the indigenous and exotic fruits and vegetables now procurable in Bombay. The rainy season which has just closed has been peculiarly rich in the fruits and vegetables commonly used by the natives of Bombay. Lieut.-Colonel K. R. Kirtikar was called upon by the Secretary to make a few observations on the fruits and vegetables profusely laid on the Society's tables. In the course of his remarks Lieut.-Colonel Kirtikar said that the Natural Orders Leguminosæ and Cucurbitaceæ formed the chief source of a large number of fruits and vegetables, such as the gourds, cucumbers, melons, and luffas. Among the members of the Leguminosæ there were various beans which when properly cooked and reasonably seasoned afford substantial as well as agreeable delicacies for men of all classes. The Gramineæ or members of the grain order, such as the sugar-cane, the rice, the wheat, the bajri, the jowari, and the nagli, are all used by the natives as the staff of life. Among the Cryptograms there is the China grass which is made into a jelly, the puff-ball, and the white Agaric.

The natives of India use various kinds of spinach—for instance, there is the ghol, the metthi, the math and tandulja ; the red and white basella, and the sea-side marsh plants machol and moras.

The natives of India season their vegetables with various articles which go under the name of *masala* which is commonly known as the curry-stuff. Most of the ingredients are of the natural order Umbelliferæ, as corriander, jira and fennel, cinnamon, cloves, red and black pepper, ginger, and turmeric, which are very largely used. Asafœtida is said to add flavour to many Indian vegetables. The Parsis never use it. The Hindus use it largely. The orthodox Brahmans never use onions and garlic, but Col. Kirtikar said he believed that a large number of Indian vegetables would be absolutely without taste if no use was made of the several seasoning ingredients mentioned above.

There was a time, say fifty years ago, when such vegetables as the lady's fingers, gourds and cucumbers could be had only during the rainy season. The unripe mango, tamarind, hog plum, limes, kurmar or kamrak and bilimdi are some of the acid fruits added to the ingredients used in flavouring vegetables. The cocoanut is very largely used in curries and for making sweetmeats. The papaya is eaten raw or cooked, and its juice renders meat tender.

A vote of thanks to the authors of the papers, which will all appear in full in the Society's Journal, was then passed, and the meeting terminated.

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Elwes, H. J. (F.R.S.)	*Europe.*
Emanuel, A. E. L. (I.C.S.)	Sholapur.
English, A. E. (I.C.S.)	Bassein, Burma.
Enthoven, R. E. (I.C.S.)	*Europe.*
Evans, Vety.-Major G. H. (F.L.S.)	Rangoon.
Evans, Lt. W. H. (R.E.)	Jubbulpore, C. P.
Fagan, Capt. E. A.	Meerut.
Fagan, H. R.	Rangoon.
Falkiner, Dr. J. M.	Dibrugarh, Assam.
Farrel, R. C. (I.F.S.)	Secunderabad.
Farrington, H. A. (I.F.S.)	Jalpaiguri, Bengal.
Fayrer, Capt. F. D. S. (I.M.S.)	*Europe.*
Fearon, H.	Coconada, Godavari District.
Fenton, Lt.-Col. L. L.	Wadhwan Camp, Kathiawar.
Ferguson, H. S. (F.Z.S., F.L.S.)	*Europe.*
Ferris, Lt.-Col. W. B.	Kolhapore.
Few, H. W.	Monywa, U. Burma.
Field, Frank	Gaya.
Finlay, C. K.	Rangoon.
Fischer, C. E. C. (I.F.S.)	Coimbatore.
Fisher, C. P.	Nagpur, C. P.
Fisher, W. F. D. (I.F.S.)	Bandra.
Fitz-Gerald, Col. H. S.	*Europe.*
Fitz-Gibbon, P. J.	Belgaum.
Fletcher, F.	Poona.
Forbes, Capt. A. H. M.	Bareilly.
Forbes, A. W.	Secunderabad.
Forbes, C. H. B.	Bombay.
Forbes, Major G. F. R.	*Europe.*
Forbes, J. D.	Jubbulpore, C. P.
Forbes-Sempill, The Hon'ble R. A.	Rangoon.
Forel, Monsieur Auguste (Hon. Correspg. Member).	*Europe.*
Forster, T. W. (B.F.S.)	Pyinmana, U. Burma.
Forsyth, Dr. W.	Calcutta.

Foster, Capt. R. B. B. (I.M.S.)	Secunderabad, Deccan.
Foster, R. Guy	Sallebile P. O., Kadur District.
Foulkes, George F. F. (I.F.S.)	Coconada, Godaveri District.
Foulkes, Capt. H. D.	*Europe.*
Foulkes, R.	Russellkonda, Ganjam District.
Foulkes, Capt. T. H. (I.M.S.) (Life Member)	Chingleput, Madras Presidency.
Fountouklis, E.	*Europe.*
Fox, Col. H. C. (R.E.)	Dharwar.
Fraser, Capt. H. A. D. (R.E.)	Dehra Dun.
Fraser, The Hon'ble Mr. S. M. (I.C.S., C.I.E.)	Bangalore.
Frenchman, Lt.-Col. E. P. (I.M.S.)	Rangoon, Burma.
Friedlander and Son, Messrs. R.	*Europe.*
Fuller, Dr. Chas. A.	Cawnpore.
Fulton, Hon'ble Mr. E. M. (I.C.S., C.S.I.)	Bombay.
Fulton, Capt. H. T. (D.S.O.) (Life Member)	Fategarh.
Fulton, Lt.-Col. R.	*Europe.*
Fry, J. F.	Parel, Bombay.
Fyson, Prof. P. F.	Madras.
Gale, Capt. E. S.	Aijal, Lushai Hills.
Galloway, R.	Secunderabad.
Gamble, J. S. (F.L.S.)	*Europe.*
Gammie, Prof. G. A.	Poona.
Garrett, H. B. G. (S.F.S.)	Moulmein, Burma.
Gaye, W. C.	Secunderabad.
George, C. P.	Secunderabad.
Gerhardt, Paul	Karli, G. I. P. Ry.
Ghosal, J. (I.C.S.)	*Europe.*
Gibbs, H. M.	Satara.
Gilbert, C. E. L. (I.F.S.)	Dhulia.
Gilbert, Reg. (F.Z.S.)	Bombay.
Gilbert-Cooper, W. J. (I.F.S.)	Moulmein.
Gill, H.	Bombay.
Gillum, S. J.	Bombay.
Gimlette, Lt.-Col. G. H. D. (C.I.E., I.M.S.)	Hyderabad, Deccan.
Gladstone, H. S. (F.Z.S.)	*Europe.*
Glaeser, John	Bombay.
Glascock, L. C.	*Europe.*
Glazebrook, N. S.	Bombay.
Gleadow, F. (F.R.M.S., I.F.S.)	Bandra.
Gloster, Capt. J. H. (I.M.S.)	Amritsar Dist.
Godden, A. L.	Fezpur, Assam.
Godfrey, G. C.	*Europe.*

Godwin-Austin, H.	Amroati, Berar.
Gonsalves, Dr. J. F.	Bandra.
Gordon, D. M.	Keng Tung, S. Shan States.
Gore, F. C.	Sibsagar, Assam.
Gore, Col. St. G. C. (R.E.)	*Europe.*
Gossage, T. N.	Maskeliya, Ceylon.
Gough, Major C.	Babugarh, U. P.
Gover, A. A.	Koraput, Vizagapatam District.
Graham, Lt. B. C.	Dharamsala, Punjab.
Graham, C. E. R. (I.C.S.)	Mundla, C. P.
Graham, D. N.	Bombay.
Graham, J. A.	Mercara, Coorg.
Graham, L. (I.C.S.)	Dharwar.
Graham, Capt. R. B.	Rangoon.
Grant, C. F. (I.C.S.)	Rangoon.
Grant, John F.	*Europe.*
Gray, Chas.	Coonoor.
Gray, P. B.	Bombay.
Greany, Surgeon-Genl. J. P. (I.M.S.)	Bombay.
Greaves, S. E.	Bombay.
Green, E. Ernest (F.E.S.)	Ceylon.
Gregerson, Dr. J. D.	Jaipur, Assam.
Greig, Joseph	Cachar.
Griffith, Capt. R. H. (R.F.A.)	Kirkee.
Griffiths, V. M. (P.W.D.)	Nasik.
Grönvold, H.	*Europe.*
Grubbe, Major E. A.	*Europe.*

Habibuddin, S. (N.C.S.)	Hyderabad, Deccan.
Haeberle, Curt. (I.F.S.)	Quilon.
Haigh, P. B. (I.C.S.)	Karwar.
Hale, Major C. H. (R.A.M.C.)	Rangoon.
Hall, William	Ahmedabad.
Hamerton, Capt. A. E. (R.A.M.C.)	Ferozepore, Punjab.
Hamilton, J. D. (B.F.S.)	Rangoon.
Hampson, Sir George F. (Bart.) (F.L.S., F.E.S.)	*Europe.*
Hankey, A. A.	Colombo.
Hankin, A. C. (C.I.E.)	Hyderabad, Deccan.
Hannyngton, W. O.	Shwebo, Burma.
Hanson, C. O. (I.F.S.)	*Europe.*
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Hardy, A. W.	Talup, Assam.
Harington, Capt. H. H.	Rangoon, Burma.
Harington, Lt.-Col. V. (I.M.S.)	Jodhpur.

Harper, E. W. (F.Z.S.)	*Europe.*
Harris, Major E. W.	Vizagapatam.
Harris, Lt. O. (R.H.A.)	Rawal Pindi.
Harrison, A. J.	Lakhimpur, Assam.
Harrison, Capt. C. B. (I.M.S.)	Madura, S. India.
Hart, E. H.	Lanowli.
Harter, R. W.	Bombay.
Harvey, Capt. W. F. (I.M.S.)	Kasauli, Punjab.
Harvey, W. L. (I.C.S.)	Calcutta.
Harwood, Lieut.-Col. J. G. (R.A.M.C.)	*Europe.*
Haslope, Rev. L. M.	Poona.
Hasted, Capt. A. W.	Kasauli.
Hasted, H. R. G.	*Europe.*
Hasted, W. A.	Tinnevelly District.
Hatch, Major A. E.	*Europe.*
Hatch, G. W. (I.C.S.)	Kaira.
Hatchell, D. G.	*Europe.*
Hate, Vinayek N.	Bombay.
Haughton, Samuel (C.C.S.)	*Europe.*
Hauxwell, T. A. (I.F.S.)	Maymyo, Burma.
Hawkins, A. B.	Calcutta.
Hayden, H. H.	Calcutta.
Hearsey, Mrs. L. D.	Lakhimpur, Kheri, Oudh.
Hearsey, T. N. (I.F.S.)	Kollegal, N. Coimbatore District.
Heath, R. H. (C.E.)	*Europe.*
Heeckerenz, Baron Von (Hon. Corrpg. Member)	Java.
Henderson, Capt. R. R.	Sialkot.
Hendley, Lt.-Col. H. (I.M.S.)	Amritsar.
Herbert, Major H. (I.M.S.)	Bombay.
Hertz, W. A.	Myitkyina, U. Burma.
Heseltine, Lt. J. E. N.	Raniket.
Heygate, Major R. H. G. (D.S.O.)	*Europe.*
Hichens, G. W.	Rangoon.
Hickman, R. St. J.	*Europe.*
Hicks, E.	Derrang, Assam.
Hide, P. (Life Member)	Rajkote.
High Range Natural History Society, The President	Aneimudi, Munaar P. O.
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Hill, Lieut. R. D. O. (Life Member)	Dehra Dun, U. P.
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Hine-Haycock, A. L.	Colombo, Ceylon.
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Hodgkinson, Col. H.	*Europe.*
Hodgson, C. P.	Ootacamund.

Hoghton, Major F. A.	Saugor, C. P.
Hojel, Major J. G. (I.M.S.)	Bombay.
Holbrooke, Capt. B. F. R.	Poona.
Hole, R. S. (I.F.S.)	Jubbulpore, C. P.
Holme, H. B. (I.C.S.)	Thayetmyo, Burma.
Holyoak, Bernard	Bombay.
Home, Lt. J. E.	Rawal Pindi.
Hoosein Belgrami, The Hon'ble Mr. Syed Nawab Imud-ul-Mulk Bahadoor	Hyderabad,Deccan.
Hooton, Capt. A. (I.M.S.)	*Europe.*
Hope, A. J. R.	Shwebo, Burma.
Hopwood, J. C.	Rangoon.
Hornidge, S.	*Europe.*
Hoskyn, Major C. R. (R.E.)	Bombay.
Hotson, J. E. B. (I.C.S.)	Rajkote,Kathiawar.
Howell, E. B.	Nanking, China.
Howlett, Col. A. (I.S.C.)	*Europe.*
Hudson, Major C. T. (I.M.S.)	Nasik.
Hudson, C. W. M. (I.C.S.)	Dharwar.
Hudson, Lt. P.	Nasirabad.
Huggins, J. R.	Koraput.
Hulbert, Major J. G. (I.M.S.)	Shahjahanpur, U.P.
Hume, H. R. (D.S.P.)	Ahmedabad.
Humphrey, J.	Bombay.
Humphrys, Lieut. F. H.	Peshawar.
Hunt, C. B. Holman	Ceylon.
Hunt, Dr. E. H.	Secunderabad.
Hutchinson, Lt. C. G.	*Europe.*
Hutchinson, F. G.	Uran.
Hutchinson, F. T.	Nasik.
Hyde-Cates, Lt.-Col. G. E.	Sawantwady.
Hyam, Judah (G.B.V.C., F.Z.S.) (Life Member)	Pusa, Bengal.

Ichalkaranji, The Hon'ble Narayenrao Govind, *alias* Babasaheb Ghorpade, Chief of (Life Member)	Kolhapur.
Ilbert, L. G.	Sibsagar, Assam.
Imray, Robt. S.	Peermaad, Travancore.
Indore, H.H. the Maharaja Tukuji Rao, Holkar of (Life Member)	Indore.
Inglis, Chas. M. (Life Member)	Durbhanga.
Inverarity, J. D. (B.A., LL.B.) (Life Member)	Bombay.
Ireland, S. G. deC. (I.C.S.)	Dehra Dun, U. P.
Ivens, J. H. (P.W.D.)	Agra.

Jackson, Mrs. F. E.	Gauhati, Assam.
Jackson, Major J. (I.M.S.)	Poona.

Jacob, W. R. Le Grand (I.F.S.)	Rajabhatkhawa, E. B. S. Ry.
James, Major C. H. (I.M.S.)	Patiala, Punjab.
Jamkhandi, Shrimant Parashram Ramchandra Patwardhan, The Chief of (Life Member)	Kolhapore.
Jamsetji, M. Doctor	Bombay.
Janjira, H. H. Sir Sidi Ahmed Khan (K.C.I.E.), Nawab of (Life Member)	Janjira.
Jardine, A. J. A. (D.S.P.)	Rangoon, Burma.
Jardine, E. R.	*Europe.*
Jardine, M. R.	Bombay.
Jardine, W. F.	Karwar.
Jayakar, Lt.-Col. A. S. G. (I.M.S.)	Bandra.
Jellett, H. H.	Khargpur, Madras Presidency.
Jencken, Lt.-Col. F. J. (R.A.M.C.)	Deolali.
Jenkins, S. E. F. (I.F.S.)	Loilem, S. Shan States, Burma.
Jennings, Major W. E. (I.M.S.)	Poona.
Jermyn, Lt.-Col. T.	Saugor, C. P.
Jesse, William	Meerut.
Jewett, Miss L.	Dhubri, Assam.
John, H. C. (C.E.)	*Europe.*
Johnson, S. M.	Cawnpore.
Johnstone, J. W. D.	Gwalior, C. I.
Joll, Lieut. H. H. (R.F.A.)	Ahmednagar.
Jones, Major F. W. C. (R.A.M.C.)	Nasirabad.
Jones, Major J. Lloyd (I.M.S.)	Bombay.
Jones, Capt. M. D. Goring	Nagpur, C. P.
Jones, T. M.	Rangoon.
Jones, W. Harvey	Bombay.
Jowitt, John F.	Bandarwella, Ceylon.
Joyce, S.	Bombay.
Jukes, J. E. C. (I.C.S.)	Broach.
Julius, Capt. S. de V. A.	Deolali.

Kagal, Meherban Piraji Rao Bapu Saheb Ghote, Chief of	Kagal, S. M. C.
Karachi, The Curator, Victoria Museum	Karachi, Sind.
Kasauli, The Secretary, Kasauli Club	Kasauli.
Kearns, A. S.	Negapatam.
Keary, Lt.-Col. H. D.	*Europe.*
Keddie, D. L. Honinelongyee	Papun, Burma.
Keighly, Lt. H. D. S.	Myitkyina, Burma.
Kellie, Col. R. H.	*Europe.*
Kelly, B. P.	Mansi, Banmank Katha, Burma.

Kelly, Capt. C. R. (R.G.A.)	Kohat.
Kelsall, Capt. H. J. (R.A.)	Hongkong.
Kemball, H. V. (C.E.)	Bombay.
Kemp, Capt. D. C. (I.M.S.)	*Europe.*
Kemp, N. W.	Bombay.
Kendall, C. H. B. (I.C.S.)	Allahabad, U. P.
Kendall, Capt. C. J. (R.I.M.)	*Europe.*
Kennedy, R. M. (I.C.S.)	Ahmedabad.
Kenny, S. D. (I.F.S.)	*Europe.*
Kenyon, James	Karachi.
Ker, L. B.	Bombay.
Kergarion, Comte de	Paris.
Kerkhoven, E. J. (Hon. Correspg. Member)	Java.
Kerr, Dr. A. F. G.	Chiengmai, Siam.
Kerr, H. R.	Sinbo, Burma.
Kettlewell, Lieut. H. W.	Fyzabad, Oudh.
Keys, H. W. (I.F.S.)	*Europe.*
Keys, Capt. W. D. A. (I.M.S.)	Bombay.
Khan, Muncherji Framji (Life Member)	Colombo, Ceylon.
Khareghat, M. P. (I.C.S.)	Dharwar.
Kilby, R. G. (I.C.S.)	Ranchi.
Kilkelly, Major P. P. (I.M.S.)	Alwar.
Kinloch, A. M.	Kil-Kotagiri, Nilgiris.
Kirkpatrick, W. McColin	Delhi.
Kirtikar, Lt.-Col. K. R. (I.M.S.)	Andheri, Thana District.
Knox, Major A. R. (R.F.A.)	Jubbulpore, C. P.
Knyvett, W. A.	Gaya, Bengal.
Kolhapur, H.H. the Maharaja Sir Shahu, Chhatrapati (G.C.S.I, G.C.V.O.) (Life Member)	Kolhapur.
Kotah, H.H. the Maharaja Umed Sing, Bahadoor (K.C.S.I.) (Life Member)	Kotah.
Kotewal, A. B.	Bombay.
Kunwar Kushal Pal Singh	Rais Kotila, Agra District.

Lace, John H. (I.F.S., F.L.S.)	Rangoon.
Lahore Zoo, The President, Committee of Management	Lahore.
Laird-MacGregor, E. G. L. (I.C.S.)	Karwar.
Lamb, Capt. Geo. (I.M.S.)	Bombay.
Lamb, R.A. (I.C.S., C.I.E.) (Life Member)	Calcutta.
Lamington, H. E. Lord (G.C.M.G., G.C.I.E.)	Bombay.
Land Records and Agriculture, The Director of	Poona.
Lane, Capt. W. H.	Kalemyo, U. Burma.
Lang, Capt. C. F. G.	Madras.
Lawrie, A. S. (P.W.D.)	Tinnevelly District.

Lee, Capt. A. W. H.	Lansdowne, U. P.
Lees, D. H. (Life Member)	Tezpur, Assam.
Leeson, G. W.	Goalundo, E. B. S. Ry.
Leete, F. A. (F.C.H., I.F.S.)	Minbu, Burma.
Lefroy, H. M. (M.A., F.E.S., F.Z.S.)	Pusa, Bengal.
Le Mesurier, H. P. (C.E.)	Calcutta.
Lennox, Lt. G. M.	Lashio, N. Shan States.
Leslie, A. K.	Bombay.
Leslie, Major G. A. (R.E.)	Kirkee.
Lester, Major C. D.	Fort Sandeman.
Lethbridge, Capt. W. (I.M.S.)	Muscat.
Light, Lt.-Col. R. H.	*Europe.*
Light, Capt. W. A.	*Europe.*
Lightfoot, S. St. C.	Taunggyi, U. Burma.
Lincoln, Capt. C. H. (I.M.S.)	Bombay.
Lindley, E. S. (C.E.)	Raipur, C. P.
Linnell, Fred.	Rangoon.
Liston, Capt. W. G. (I.M.S.)	Parel.
Little, F. D.	Banmauk P. O., Katha, U. Burma.
Lloyd, Col. O. E. P. (V.C., R.A.M.C.)	Ootacamund.
Loam, Mathew	Berhampur.
Lock, Capt. F. R. E. (I.S.C.)	Mhow, C. I.
Lodge, G. E.	*Europe.*
Logan, A. C. (I.C.S.)	Poona
Logan Home, Lt. G. R. S.	Deesa.
Long, G. R. (I.F.S.) (Life Member)	Tunggyi, U. Burma.
Long, H. W. (R.A.M.C.)	Jullundur.
Longden, C. C.	Palamcottah, Madras Presidency.
Lory, F. B. P. (M.A.)	Poona.
Loudon, Major J. A.	Aurungabad.
Lovegrove, W. H. (I.F.S.)	Naini Tal.
Lowndes, G. R.	Bombay.
Lowrie, A. E. (I.F.S.)	Raipur, C. P.
Luard, E. S.	*Europe.*
Lucknow, The Curator & Sec., Provincial Museum	Lucknow.
Lumley, Major F. D.	*Europe.*
Lumsden, O. F. (I.C.S.)	Jhelum, Punjab.
Lushington, R. H.	Vizagapatam.
Lyall, Lt. R. A.	*Europe.*
Lyell, Lt. A. G.	*Europe.*
Lynch, C. B.	*Europe.*
Lynn, G. R. (C.E.)	Manora, Karachi.

Macaulay, L. A.	Bombay.
Macaulay, R. H.	*Europe.*
MacDonald, Dr. D. (Life Member)	*Europe.*
MacDonald, J.	Bombay.
MacDonald, K. C. (D.S.P.)	Pokukku, Burma.
MacGregor, Lieut. R. D. (I.M.S.)	Bombay.
MacLeod, Capt. E. C. (I.M.S.)	Gauhati, Assam.
MacMillan, D. A.	Keonjhar, Orissa.
Mackay, C. J.	Mozufferpur.
Mackenzie, Major A. F.	Poona.
Mackenzie, Colin A.	Ootacamund.
Mackenzie, Kenneth	Kurnool, Madras.
Mackenzie, Lt. K. L. W.	Fyzabad.
Mackenzie, M. D.	Hyderabad, Sind.
Mackenzie, M. M.	Saran, Bengal.
Mackie, A. W. W. (I.C.S.)	Belgaum.
Mackinnon, P. W. (F.E.S.)	Mussoorie.
Mackwood, F. M.	Colombo.
Maclaren, J. Malcolm (F.G.S.)	Calcutta.
Macleod, Norman A.	*Europe.*
Macleod, N. C.	Bombay.
Macnaghten, H. W. P.	Bombay.
Macpherson, John	*Europe.*
Macpherson, Col. T. R. M.	*Europe.*
Mactaggart, H. B.	Negapatam.
Madras, The Professor of Zoology, Madras Christian College	Madras.
Madras, The Principal, Medical College	Madras.
Madras, The Principal, Presidency College	Madras.
Madras, The Librarian, Govt. Central Museum	Madras.
Magrath, Major H. A. F.	Kohat.
Mahaluxmiwalla, C. D.	Bombay.
Mahomedbhoy Currimbhoy Ebrahim	Bombay.
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Maitland, Lt.-Col. C. B. (I.M.S.)	*Europe.*
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Malcolm, T.	Rajamundry.
Mallins, Col. C. (I.M.S.)	*Europe.*
Manders, Major N. (R.A.M.C., F.Z.S., F.E.S.)	Mauritius.
Mandlik, Narayan V. (Life Member)	Bombay.
Mann, H. H.	Calcutta.
Manners-Smith, Major J. (V.C., C.I.E.)	Nepal.
Manson, Lieut. B. E. A.	*Europe.*
Manson, C. E. F.	Rangoon.
Marjoribanks, G. (I.F.S.)	Belgaum.
Marryat, A.	Bombay.
Marsden, E.	Bombay.
Marshall, Arch. McL. (Life Member)	*Europe.*

Marshall, D.	Pamaru, Nellore District.
Marshall, J. McL. (Life Member)	*Europe.*
Marshall, Capt. T. E. (R.A.)	*Europe.*
Marten, James	DehraDun, N.-W.P.
Martin, Lieut.-Col. Gerald (Life Member)	*Europe.*
Martin, L. K.	Buldana.
Masani, A. M. (Life Member)	Baroda.
Masson, The Hon'ble Sir D. P. (KT., C.I.E.)	Lahore.
Masson, W. P.	Darjeeling.
Massy, Major H. S.	*Europe.*
Maxwell, F. D.	Maubin, Burma.
Maxwell, W.	Moran P. O., Sibsagar, Assam.
Maxwell, Lt. W. F. (R.E.)	Kirkee.
May, Lt. H. S. (R.E.)	Camp *viâ* Bannu, N.-W. Frontier.
May, J.	Parlakimedi, Ganjam District.
Mayer, C. A.	Bhadarwa P. O., Jammu State.
Mayne, Capt. H. B. (R.G.A.)	*Europe.*
McCarrison, D. L. (D.S.P.)	Cuddapah, Madras Presidency.
McCormack, R. B.	Cocanada, Godavari District.
McDonough, A.	Murree, Punjab.
McDougall, E. (D.S.P.)	Sandoway, Burma.
McGlashan, John (C.E.)	Calcutta.
McIntosh, Alex. (C.E.)	Quilon, Travancore.
McIntosh, R. (I.F.S.)	*Europe.*
McKay, Lt.-Col. H. K. (I.M.S.)	Calcutta.
McKearon, R. G. (M.A., I.C.S.)	Rangoon.
McKendrick, Capt. A. G. (I.M.S.)	Kasauli, Punjab.
McKenna, J. (I.C.S.)	Bassein, Burma.
McKenna, Lieut. J. C.	Manipur, Assam.
McKenzie, Alex.	Bombay.
McLaughlin, Lt. H. D.	Abbottabad.
McLeod, Major-Genl. D. J. S. (C.B., D.S.O.)	Maymyo, Burma.
McMahon, Col. Sir A. H. (C.I.E., C.S.I.)	*Europe.*
McMullen, Dr. G. C.	Kotri, Sind.
McNeill, J. (I.C.S.)	Poona.
McPherson, Lieut. J. (I.M.S.)	Bombay.
Mead, Capt. H. R.	Nasirabad.
Mead, P. J. (I.C.S.)	Ahmedabad.
Meade, Col. M. J. (C.I.E.)	Baroda.
Mears, Capt. A. (I.A.)	Calcutta.

Meinertzhagen, Lieut. R.	Mombassa.
Menon, K. G.	Trichor, Cochin.
Merewether, Major H. D.	Palanpur.
Merwanji Pallonji Talati	China.
Mess President, 29th Lancers	Sirur, Poona Dist.
Mess President, 34th Battery, R. F. A.	*Europe.*
Mess President, 38th C. I. Horse	Goona, C. I.
Mess President, 44th Merwara Infantry	Ajmer.
Mess President, 110th Mahratha L. Infantry	Poona.
Mess President, 130th Baluchis	Hyderabad, Sind.
Mess President, R.A.	Roorkee.
Mess President, South Wales Borderers	Karachi.
Messent, P. G. (C.E.)	Bombay.
Metcalfe, T. J.	Rangoon.
Metge, Lt. R.	Quetta.
Meyer, Major C. H. L. (I.M.S.)	Bombay.
Meyer, Dr. F. A.	Bombay.
Meyer, O.	Bombay.
Meyrick, E. (F.R.S.)	*Europe.*
Millard, W. S. (F.Z.S.) (Life Member)	Bombay.
Miller, G. A.	Darjeeling.
Millett, G. P. (I.F.S.)	*Europe.*
Mills, J. D. (Life Member)	*Europe.*
Milne, Major C. J. Robertson (I.M.S.)	Lahore.
Minniken, G. G. (I.F.S.)	Simla.
Miraj, Shrimant Gungadharrao Ganesh, *alias* Babasaheb Patwardhan, Chief of (Life Member)	Miraj.
Mitchell, J. C. H.	Derrang, Halem P. O., Assam.
Mitchell, Dr. W.	*Europe.*
Moberly, Mrs. B. M.	Hyderabad, Deccan.
Mockler, Major G. F.	Deolali.
Modi, Bomanji Edulji	Kaira.
Moggridge, C. B.	Rangoon.
Molesworth, W. G.	Waltair.
Möller, F. A.	Darjeeling.
Mollison, J.	Nagpur, C. P.
Monté, Mrs. Cecilia de (L.M. & S.)	Bombay.
Monté, Dr. D. A. de (L.M. & S.)	Bandora.
Monteath, G. (I.C.S.)	Bombay.
Monteath, J. (I.C.S.)	Dharwar.
Montresor, Capt. L. B. (R.F.A.)	Trimulgherry.
Moore, T. D.	Bombay.
Moore, T.	Russelkonda, Ganjam District.
Moore, W. (F.I.C.)	Dibrugarh.
Morgan, F. E.	Pamuru, Nellore District.

Morgan, V. G. (I.F.S.)	Mundla, C. P.
Morgan, W. de (C.E.)	*Europe.*
Morison, W. T. (I.C.S.)	Surat.
Morris, Capt. A. H. (R.A.M.C.)	Bombay.
Morris, Capt. D. O.	Amraoti, Berar.
Morris, G. C.	Ceylon.
Morris, Capt. G. M.	Secunderabad, Deccan.
Moscardi, E. H. (I.C.S.)	*Europe.*
Mosse, Lt. A. H. E. (I.S.C.)	Aden.
Mowbray, G. B. De	Ceylon.
Mowbray, Lt. J. L. (R.F.A.)	Barrackpore.
Moylan, W.	Calcutta.
Mudhol, Shrimant Malojirao Rage Ghorpade, Chief of	Mudhol, S. M. C.
Mullalay, C. (I.C.S.)	Ootacamund.
Müller, Professor O. V.	Bombay.
Mullins, Lt.-Col. W. B.	Dehra Ismail Khan.
Mumford, E. G. (D.S.P.)	Maubin, Burma.
Mumford, J.	Bombay.
Mundy, N. S.	Dibrugarh, Assam.
Munna Lâl, Dr.	Ballia, N.-W.P.
Murray, S. B. (P.W.D.)	Ootacamund.
Muspratt, E. (D.S.P.) (Life Member)	*Europe.*
Muspratt, Major F. C.	Shau-hai-Kwan, N. China.
Mysore, The Superintendent, Mysore Government Museum	Bangalore.
Mysore, H.H. the Maharaja Krishna Raj Woodayar Bahadoor of, (Life Member)	Mysore.
Nagpur, The Curator, Central Museum	Nagpur.
Nangle, H. C.	Kayuktang, Burma.
Nangle, Capt. K. E.	Secunderabad, Deccan.
Nangle, Capt. M. C.	Bhamo, Burma.
Napier, A. G. F.	Jacobabad, Sind.
Naranji Dwarkadas (Life Member)	Bombay.
Narasiah, C. V.	Coimbatore, Madras Presidency.
Narrotumdas Morarji Goculdass (Life Member)	Bombay.
Nasrulla Khan, H. H. Nawab Mahomed	Bhopal, C. I.
Navanagar, H.H. Maharaja Shri Jaswat Singji, the Jam Saheb of (Life Member)	Rajkote.
Newill, T. N. C.	*Europe.*
Newnham, Major A. (F.Z.S.)	Lucknow.
Nicholson, E. F.	Bombay.
Nicholson, Capt. W. C.	Vizianagram.

Nigel-Jones, M. E.	Dibrugarh, Assam.
Nisbet, J. E. S.	Pynmana, Burma.
Nisbett, Capt. W. G.	Rangoon, Burma.
North, Julian	Calcutta.
Norvill, Dr. T. H. (M.D.)	Lakhimpur.
Nurse, Major C. G. (F.E.S.) (Life Member)	*Europe.*
Nurse, Capt. H. H.	Aden.
Nuttall, W. M.	Dibrugarh, Assam.
Oakden, R. M. (I.C.S.)	Ballia, U. P.
Oakes, M. L. (D.S.P.)	Gonda, Oudh.
Oates, E. W. (Hon. Correspg. Member)	*Europe.*
O'Brien, Capt. Edward	Aden.
Ogilvie, A. W. (I.F.S.)	Paknamps, Siam.
Ogilvie, Major E. C. (R.E.)	Poona.
Okeden, W. P.	Rangoon.
Oldham, Capt. L. W. S. (R.E.)	*Europe.*
Oliver, A. K.	Bombay.
Oliver, J. W. (I.F.S.)	*Europe.*
Olivier, Lt.-Col. H. D. (R.E., F.Z.S.) (Life Member)	Bombay.
Ollivant, Capt. A. H.	*Europe.*
Opiumwalla, Dorab E.	Bombay.
Orr, Capt. H. M. C.	Trimulgherry, Deccan.
Orr, J.P. (I.C.S.)	Ahmednagar.
Osborn, Lt.-Genl. W.	Naggar Kullu, Kangra District.
Osmaston, B. B. (I.F.S.)	Port Blair.
Osmaston, L. S. (I.F.S.)	Nasik.
Oxley, Lt. J. C. S. (I.M.S.)	Seoni, Chappara.
Ozzard, Major F. R. (I.M.S.)	Tongshan, N. China.
Packard, Capt. H. N. (R.A.)	Naini Tal.
Page, W. G.	Poona.
Page, W. T. (F.Z.S.)	*Europe.*
Pallant, Lieut. S. L. (R.A.M.C.)	Jubbulpore, C. P.
Pam, Albert	*Europe.*
Panton, A.	Bombay.
Parasu Ramdas Patro, A. (B.A.)	Berhampur.
Parrington, Lt. J. W. (R.A.)	Hyderabad, Sind.
Parsons, H. J.	*Europe.*
Partridge, E. A.	Secunderabad, Deccan.
Partridge, Henry (Life Member)	Pyinmana, Burma.
Pasco, J. Harding	Kulla Kambay, Nilgiris.
Pasteur Institute of India, The Director	Kasauli, Punjab.

Patterson, Dr. R. L.	Sibsagar, Assam.
Patton, Lt. W. S. (I.M.S.)	Madras.
Pawalla, Jamsetji C.	Bombay.
Payn, Capt. W. A.	Deolali.
Pearce, Capt. C. R. (I.M.S.)	Maymyo, Burma.
Pearless, S. H.	Ceylon.
Pearse, Lt. G.	Agar, Malwa.
Pearson, R. S. (I.F.S.)	Godhra.
Pechey-Phipson, Mrs. (M.D.)	Nasik.
Peiniger, W. G.	Chiengmai, *viâ* Moulmein.
Peirce, H. B.	Bombay.
Penno, Dr. F. L. (M.R.C.S, L.R.C.P.)	Bombay.
Perreau, Capt. G. A.	Bakloh, Punjab.
Perrot, Lt. H. S. (R.G.A.)	*Europe.*
Pershouse, Lt. S.	Middelburg, Transvaal.
Pestonji Jivanji (N.C.S.) (Life Member)	Hyderabad, D.
Peters, Lt.-Col. C. T.	Dinajpur.
Petit, Bomanji Dinshaw (Life Member)	Bombay.
Petit, Dhunjibhoy Bomanji (Life Member)	Bombay.
Petit, Jehangir Bomanji (Life Member)	Bombay.
Petrie, Dr. G. F.	Parel.
Phear, G. A. (P.W.D.)	Nagpore, C. P.
Phillott, Col. D. C.	Kerman, Persia.
Phipson, H. M. (C.M.Z.S.) (Life Member)	Bombay.
Pilcher, Major A. J. (R.E.)	Murree, Punjab.
Pilcher, Col. J. G. (I.M.S.)	*Europe.*
Pile, J.	Secunderabad, Deccan.
Pinhey, Major A. F. (C.I.E.)	Oodeypur.
Pink, H. F. L.	Debra Dun.
Pocock, Capt. P. F.	Aden.
Polwhele, A. C. (C.E.)	Agra.
Poncins, Baron Edmond de (Life Member)	*Europe.*
Porch, Capt. C. P.	Ranikhet.
Porteous, Lt. D. M.	Poona.
Pottinger, Lieut. J. A.	Wellington.
Praed, Lt. G. A. M.	Dinapore.
Prain, Major D. (I.M.S.)	*Europe.*
Prall, Major S. E. (I.M.S.)	Aden.
Pratt, F. G. (I.C.S.)	Godhra.
Prescott, Lieut. C. W.	Banu, Punjab.
Preston, F. J.	Bombay.
Price, Sir Fred.	Ootacamund.
Prichard, G. M.	Ramtek, C. P.
Prideaux, G. W. B.	Taunggyi, Burma.
Priestley, Capt. C. E. N.	Belgaum.

Primrose, Alex. M.	Tanarhat P. O. Gauripur, Assam.
Prior, Lt.-Col. W.	Ranchi.
Proctor, H. E.	Bombay.
Purkis, H. V.	Tissa, P. O., Chumba State.
Purshotumdas Visram Mosji	Bombay.
Raby-Noble, W.	Behali P.O., Assam.
Raikes, E. B., Hon'ble Mr.	Bombay.
Rajkumar College, the Principal	Rajkote.
Ranger, G. O.	Calcutta.
Rattray, Lt.-Col. R. H.	Fort Munro, Dehra Gazi Khan.
Ravenshaw, Lt.-Col. C. W. (Life Member)	*Europe.*
Rawlins, Major G. W.	Poona.
Ready, Capt. B. T.	Quetta.
Readymoney, N. J.	Bombay.
Rebello, Revd. João	Margoa, Goa.
Rees, H. C.	Pegu, Burma.
Rees, W. E.	Gaya, Bengal.
Reeve, J. L.	Cawnpore.
Reeve, R.	Bombay.
Reid, Cecil H. (I.C.S.)	Calcutta.
Reid, M. F. (C.I.E.)	Bombay.
Reid, W. J. (I.C.S.)	Kohima, Assam.
Rendall, H. D. (I.C.S.)	Rajkote.
Rennie, Thos. (I.C.V.D.)	Rangoon.
Reynolds, L. W. (I.C.S.)	Indore, C. I.
Reynolds, P. (C.E.)	*Europe.*
Rhé-Philipe, G. W. V. de	Bombay.
Rhenius, C. E.	Cuddalore, S. Arcot District.
Rhodes, T. M.	Dilwa, Palwas P. O., Gaya Dist.
Rice, Lieut. B. A.	Nigeria.
Richardson, Cecil	Ajmer.
Richardson, Lt. G. G.	Karachi.
Richardson, H. L.	Bombay.
Richardson, Lt.-Col. W. St. John	Rawal Pindi.
Richmond, R. D. (I.F.S.)	Palamcotta, Madras Presidency.
Ritchie, Capt. C. McI. (R.H.A.)	Rawal Pindi.
Ritchie, F.	Bombay.
Roberts, Lieut. A. S. B.	Minbu, Burma.
Roberts, Major M. B. (Life Member)	Chitral.
Robertson, B. (I.C.S., C.I.E.)	Nagpur, C. P.
Robertson, Col. Sir D. (K.C.S.I.)	*Europe.*

Robertson, J. H. (I.C.S.)	Mangalore.
Robertson, L. (I.C.S.)	Calcutta.
Robinson, H. K. (I.F.S.)	Darjeeling.
Robinson, John, J.	Ceylon.
Rodger, A. (I.F.S.)	Thayetmyo, Burma.
Rodon, Major G. S. (F.Z.S.)	Dharwar.
Rogers, C. G. (I.F.S.)	Port Blair.
Rogers, Henry (M.R.C.V.S.)	*Europe.*
Rogers, J. B. L.	Bombay.
Rogers, Rev. K. St. A.	Mombassa, South Africa.
Romilly, A. G. (C.E.)	Bezwada, Madras Presidency.
Ross, Major, Tyrell (Life Member)	Dinapore.
Routh, R. S.	Chittagong.
Row, Dr. R. (M.D.)	Bombay.
Rowland, Dr. S.	Parel.
Ruddle, W. H.	Secundrabad.
Russell, J. B.	Hanbalu, Mysore.
Russell, Hon'ble Mr. Justice L. P.	Bombay.
Ryan, G. M. (I.F.S.)	Poona.
Rylands, H. R.	Bombay.
Ryves, A. E.	Allahabad.
Sale, Edward L. (I.C.S.)	Larkhana, Sind.
Salkeld, Lt. R. E.	Mombassa, East Africa.
Salmon, Lt. W. H. B.	Bolarum.
Saone, G. Prier De	Bombay.
Sassoon, Mrs. S. D.	Bombay.
Saunders, Capt. F. W. (R.E.)	Bombay.
Savile, L. H.	Bombay.
Schletter, Lt.-Col. P. (C.B.)	Rangoon.
Scindia, H. H. the Maharaja Madho Rao (Life Member)	Gwalior.
Scot, J. S. (I.F.S.)	Nandyal, Kurnool District.
Scotson, J. T. (I.C.S.)	Bombay.
Scott, Edmund	Ceylon.
Scott, Capt. G. B.	Multan.
Scott, G. C.	Ceylon.
Scott, J. (M.I.C.E.)	Calcutta.
Scovell, C. E.	Loilem, S. Shan States.
Scroggie, Capt. W. R. J. (I.M.S.)	Fort Lockhart, Samana, N.W.F.P.
Scroope, H. W. P. (I.C.S.)	Agartola Hill, Tippera, Bengal.

Seal, Dr. C. E. B.	Darjeeling.
Sealy, Capt. A. E.	Bakloh, Punjab.
Sears, R. H. (C.E.)	Babnisal, *via* Ranigang.
Seervai, Dr. Rustom F.	Bombay.
Selous, Capt. R.	Mhow, C. I.
Service, Geo.	Bombay.
Seton-Karr, H. W. (Life Member)	*Europe.*
Sewell, J. H.	Rangoon, Burma.
Sharp, Professor W. H.	Bombay.
Shaw, Lt. W. S. J.	Rajkote.
Shipp, W. E.	Bombay.
Shortland, C. V. N. (A.M.I.C.E.)	Chakradharpur, Bengal.
Shoubridge, H. O. B. (C.E.)	Nasik.
Shuttleworth, Capt. A. R. B.	Rawal Pindi.
Sikes, F.	*Europe.*
Silvester, Dr. C. E.	Kajaldhara P. O., S. Sylhet.
Simcox, A. H. A. (I.C.S.)	Poona.
Simcox, Lt. C. T.	Ranikhet.
Simpson, J. Hope (I.C.S.)	Naini Tal.
Simson, Lt. R.	Umballa.
Sind Club, The Hony. Secretary	Karachi.
Sitwell, Capt. N. S. H. (R.A.)	Dum Dum.
Skey, Capt. F. E. G. (R.E.)	Jamaica.
Skipwith, Capt. J. W. (R.E.)	Kirkee.
Slade, H. (I.F.S.)	Maymyo, Burma.
Sladen, J. (I.C.S.)	Bombay.
Sladen, Dr. R. J. L.	Igatpuri.
Slater, E. M.	*Europe.*
Slater, J. Sanders	Bombay.
Smales, Chas. B. (I.F.S.)	Katha, Upper Burma.
Smith, Capt. F. A. (I.M.S.)	Ulwar.
Smith, Lt. H. H.	Cawnpore.
Smith, Major O. A.	Mooltan.
Souter, C. A. (I.C.S.)	Masulipatam, Madras.
Span, Capt. H. J. B.	Quetta.
Sparke, W.	Rangoon, Burma.
Spence, J. R.	Bombay.
Spence, L. H. (D.S.P.)	Poona.
Spence, R. A.	Bombay.
Spooner, T. J. (C.E.) (Life Member)	Gadag, S. M. Ry.
Stables, Major Alex. (R.A.M.C.)	Karachi.
Standen, B. (I.C.S.)	Betul, C. P.
Stanton, W. C.	Golakganj, E.B.Ry.

Staples, E. W. H. (C.E.)	Dum Dum.
Stebbing, E. P. (I.F.S., F.L.S., F.E.S.)	Dehra Dun.
Steel, Sergeant-Instructor Alex.	Bolarum.
Steel, Lt. D. (I.M.S.)	Calcutta.
Stehelen, A.	Falam, Chin Hills.
Steiner, E.	Bombay.
Stephens, L. B.	Karachi.
Stericker, Staff Surgeon W. (R.N.)	*Europe.*
Stevens, Herbert	Lakhimpur, Assam.
Stewart, Capt. G. H. (I.M.S.)	Falam, Chin Hills.
Stewart, J. Lee	Bilur, Mysore.
Stewart, R. B. (I.C.S.)	Poona.
Stigand, Lt. C. H.	*Europe.*
Stirling, G. C. B.	Lashio, N. Shan States.
Stockley, Lt. J. P.	Kherwara, Rajputana.
Stoney, R. F.	Bezwada.
Storey, Thos. H.	Oodeypur.
Story, S. S.	Bombay.
Stowell, C. H.	Bombay.
Stringfellow, H. P.	Bombay.
Strong, F. W. (I.C.S.)	Shillong, Assam.
Stuart, Capt. A. G.	Calcutta.
Stuart, C. J.	Nellore.
Stuart, G. A. D.	Pollachi, Coimbatore District.
Stuart, J. D.	Mandalay, Burma.
Stuart, Major J. R. (R.A.M.C.)	*Europe.*
Sturrock, Capt. G. C. (R.A.)	Wellington.
Subramanian, V. (M.A.)	Denkanikota, Salem District.
Sulivan, Col. G. D. F.	Bombay.
Summers, Thos. (C.E.)	Karachi.
Surveyor, Dr. N. F. (M.D.)	Bombay.
Swan, Capt. C. T.	Ootacamund.
Swan, H. H.	*Europe.*
Swayne, Herbert (Life Member)	*Europe.*
Swinhoe, Col. C.	*Europe.*
Swinhoe, R. C. J.	Mandalay. Burma.
Sykes, C. M. (C.E.)	Jamnagar.
Sykes, M. G. (I.C.S.)	Gudur, Madras Presidency.
Symes, W. C.	Bombay.
Symington, J. H.	Bombay.
Symons, Lieut. H. (R.G.A.)	Saugor, C. P.
Tagart, Major H. A. L. (D.S.O.)	Meerut.

Talbot, W. A. (I.F.S.)	Belgaum.
Tambe, Dr. Gopal Ramchandra, (M.A., B.SC., L. M.& S.)	Indore, C. I.
Tanner, Capt. C. O. O.	Quetta.
Tata, Dorabji J. (Life Member)	Bombay.
Taylor, James H.	*Europe.*
Tejpal, Goverdhundas Goculdas (Life Member)	Bombay.
Temulji B. Nariman, Dr.	Bombay.
Tenasserim Agri-Horticultural Society, The Honorary Secretary of the	Moulmein.
Thanawala, Y. D. (M.A.)	Bombay.
Thompson, H. N. (F.Z.S., I.F.S.)	Taunggyi, Burma.
Thompson, R. C. (I.F.S)	Bangkok, Siam.
Thompson, R. H. E. (I.F.S.)	Dehra Dun.
Thompson, St. C.	Lucknow.
Thomson, Major D. B.	Bombay.
Thorburn, F. Seymour	Lakhimpur.
Thornhill, Col. H. B.	Simla.
Thornton, H. A. (I.C.S.)	Pyapan, L. Burma.
Thorpe, Lt. L. L. G. (R.A.M.C.)	Aden.
Tibbs, Rev. P. G.	Deolali.
Tilly, T. H. (Life Member)	Mingin, Burma.
Tinley, Col. G. F. N.	Meerut.
Tinne, P. (I.F.S.)	Kalimpong, L. Burma.
Tipper, G. H.	Calcutta.
Tod, Alex. M.	Bombay.
Todd-Naylor, H. P. (I.C.S., C.I.E.)	Meiktila, Burma.
Tomkins, Capt. E. L. (R.A.)	*Europe.*
Tomkins, S.	Allahabad.
Tooth, E. E.	Poona.
Toppin, Lt. S. M. (R.G.A.)	Abbottabad.
Tottenham, W. F. L. (I.F.S.)	Rangoon.
Townsend, Major E. C. (I.S.C.)	Mandalay.
Traill, W. H.	Bombay.
Travancore, H. H. The Maharaja Sultan Rama Raja Bahadoor (G.C.S.I., G.C.I.E.) (Life Member).	Trivandrum.
Travers, C. H.	Madras.
Trench, G. C. (I.C.S.)	Nagpur, C. P.
Trevor, Col. F. W. (R.A.M.C.)	Poona.
Trivandrum, Hon. Sec., Government Museum and Public Gardens	Trivandrum.
Trotter, E. W.	Bangkok, Siam.
Troup, N. F. T.	Kousanie P. O., Almora.
Truninger, L.	Calcutta.
Turner, Capt. C. H.	Mandalay.
Tweedie, Lt. J. L.	Umballa.
Twiss, Lt. A. M. (R.E.)	Kirkee.

Tyler, H. H. F. M. (I.C.S.)	Bhadrachalam, Godavari Dist.
Tytler, Capt. H. C.	Agra.
Ulwar, H.H. Maharaja Sawai Jey Singh Bahadoor (Life Member)	Rajputana.
Unwalla, J. N. (Life Member)	Bhavnagar.
Valentine, Capt. A. L.	*Europe.*
Vanrenen, D. H.	Lyallpur, Punjab.
Vans-Agnew, Major F. (R.A.)	Quetta.
Vaughan, J. P. (I.C.S.)	Hyderabad, Sind.
Vaughan, W.	Ceylon.
Venour, Major W. E.	Peshawar.
Vernon, H. A. B. (I.C.S.)	Madras.
Verrieres, G. C. (P.W.D.)	Fyzabad, Oudh.
Viccaji, Framji R. (Life Member)	Bombay.
Vidal, G. W.	*Europe.*
Vincent, W. H. H. (I.C.S.)	Ranchi, Chota Nagpur.
Vithuldas Damodhar Thakersey, The Hon'ble Mr.	Bombay.
Wadeson, Major F. W. G.	Fort Sandeman.
Wadia, Sorab P. N.	Bombay.
Walker, Capt. G. K. (A.V.D.)	Lahore.
Walker, Capt. W. B. (R.A.)	Bombay.
Walker, J. S. E.	Purnahia, B.
Wall, Capt. F. (I.M.S., C.M.Z.S.)	Fyzabad.
Wallace, John (C.E.)	Bombay.
Wallace, R.	Rangoon.
Wallace, W. V. (I.C.S.)	Myingyan, Burma.
Wallinger, W. A.	Alibag.
Walsh, E. P. (I.C.S.)	Penukonda, Madras Presidency.
Walter, F. (I.F.S.)	Rangoon.
Walton, Capt. H. J. (I.M.S.)	*Europe.*
Wapshare, G.	Ootacamund.
Ward, Col. A. E.	Srinagar, Kashmir.
Ward, Capt. C. H.	Malakand.
Wasey, G. K.	*Europe.*
Waterfield, E. H. (I.C.S.)	Dhulia.
Watkins, C. R.	Pyiumana, Burma.
Watson, Capt. H. D.	Dehra Dun.
Watson, H. R.	Secunderabad.
Watson, H. W. A. (I.F.S.)	Taungoo, Burma.
Watson, Lt.-Col. J. (R.A.M.C.)	*Europe.*
Watson, Capt. John C.	*Europe.*
Watson, Capt. J. W. (I.M.S.)	Turbat-i-Hyderi, Persia.

Watson, L. P.	Cawnpore.
Watson, Capt. T. E. (I.M.S.)	Kurnool.
Watson, W. M.	Bombay.
Watts, Capt. G. A. R.	Lahore.
Watts, Lt. N. H. L.	Rangoon.
Webb, M. (I.C.S.)	Dharwar.
Weldon, W. L.	Bombay.
Wells-Cole, Major H.	*Europe.*
Wenden, H. (C.E., C.I.E.)	Bombay.
Westropp, A. S. A. (I.C.S.)	Surat.
Whately, Richard	Phulera, R.-M. Ry.
Whiffin, F. D.	Rourkela, B.-N. Ry.
Whitcombe, Capt. E. G. R. (I.M.S.)	*Europe.*
White, C. W.	Bombay.
White, Lt. A. W.	Karachi.
White, G. H.	Bhusawal.
White, W. P.	Mundla, C. P.
Whitehead, Lt. C. H. T.	Kohat.
Whitehouse, Langford	Pank, Burma.
Whiting, J. E. (C.E.)	Bombay.
Whittall, Major F. V.	*Europe.*
Whittell, Lt. H. M.	Solon.
Whitworth, G. C. (I.C.S.) (Life Member)	*Europe.*
Whymper, S. L.	Jeolikote, U. P.
Whyte, Lt.-Col. C. W. F.	Fort Sandeman.
Wickham, P. F. (C.E.)	Pakoku, Burma.
Wickwar, O. S.	*Europe.*
Wiles, G. (I.C.S.)	Godhra.
Wileman, A. E. (H. B. M. Consul)	Auping, South Formosa, China.
Wilkinson, Major E. (I.M.S.)	Simla.
Wilkinson, W. A.	Madras.
Williams, A. (I.C.S.)	Quetta.
Williams, Capt. C. E. (I.M.S.)	Rangoon.
Williamson, K. B.	Jabalpore, C. P.
Williamson, W. J. F.	Bangkok, Siam.
Willis, R. A.	Bombay.
Willock, Lieut. A. (R.I.M.)	Port Blair.
Wilson, A. R.	Binsur, Almora.
Wilson, E.	Dehra Dun, U. P.
Wilson, Comdr. N. F. T. (R.I.M.)	Bombay.
Wilson, R. A. (I.C.S.)	Nagpur.
Wilson, W. G.	Bombay.
Winterscale, J. C.	Karangan, Kedah.
Witham, Dr. E. Wells (M.D.)	*Europe.*
Witt, D. O. (I.F.S.)	Bangkok, Siam.
Wolf-Murray, F. D. O. (I.C.S.)	*Europe.*
Wood, C. W. (C.E.)	Calicut, Malabar.

Wood, Lt. H. (R.E.)	Amraoti, Berar.
Wood, R. B. (I.C.S.)	Kaira.
Wood, S. A. (I.F.S.)	Loilem, S. Shan States.
Woods, Vernon (C.E.)	*Europe.*
Wooster, W. G.	Yawng Hwe, S. Shan States.
Worlledge, Lt. N. A.	Mauritius.
White, Major E. H. (I.M.S.)	Madras.
Wright, F. A. (C.E.)	Howrah, Bengal.
Wright, H.	Peradeniya, Ceylon.
Wright, H. C.	Bombay.
Wright, R. R.	Bombay.
Wright, Dr. W. B.	Lakhimpur, Assam.
Wroughton, R. C. (Life Member)	*Europe.*
Yates, Lieut. R. J. B.	Kohat.
Yeatman, Lieut. M. E.	Karachi.
Yeo, Edwin W.	Karachi.
Yerbury, Col. J. W. (R.A.) (Life Member)	*Europe.*
Young, E. H.	Ajmer.
Young, Major F. DeB.	Poona.
Young, Lt. G. G. (I.M.S.)	*Europe.*
Young, John	*Europe.*
Young, L. C. H. (B.A., F.E.S., F.Z.S.)	Bombay.
Young, Lieut. M.	Mhow.
Young, Lt. M. J. D.	Aurungabad.
Young, W. E.	Karachi.
Yule, Lt. R. A.	Mount Abu, Rajputana.

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT of ACCOUNTS (from 1st January 1904 *to* 31*st December* 1904*).*

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.
Balance in Bank on 1st January 1904.	2,912	8	9			
Cash in hand on 1st January 1904 ...	200	0	0			
Petty Cash balance on 1st January 1904	1	4	2			
				3,113	12	11
Subscription for 1901 (in arrears)	15	0	0			
Do. do. 1902 (do.)	90	0	0			
Do. do. 1903 (do.)	525	4	0			
Do. do. 1904	9,168	1	7			
Do. do. 1905 (in advance)	665	4	0			
Do. do. 1906 (do.)	4	12	0			
Do. do. Journal from Members residing outside of India	329	4	4			
Subscriptions for Life Membership..	750	0	0			
				11,547	9	11
Entrance Fees				1,380	0	0
Sale of back Journals, &c.				1,271	11	0
Grant from the Government of Bombay for 1904 ...				2,500	0	0
Interest on Government Paper				217	10	1
Interest allowed by Bank				110	2	5
Total ... Rs.				20,140	14	4

EXPENDITURE.		Rs.	a.	p.	Rs.	a.	p.
Rent of the Rooms from 1st December 1903 to 30th November 1904					1,500	0	0
Salaries from 1st December 1903 to 30th November 1904					1,409	0	0
Furniture Account					602	11	0
Library Account					27	0	0
Printing and Stationery					283	11	6
Journal Account—Cost of Printing Journals and Coloured Plates from England					8,555	6	10
Refunded to H. H. the Maharaja Gaekwar of Baroda donation made by him for a special purpose					299	15	0
Compounded Subscriptions received from Life Members invested in 3½ per cent. Government Paper					2,166	4	4
Purchase of mounted specimens for the Museum					210	0	0
General Expenses					1,011	6	1
Postage					691	15	2
Balance in Bank on 31st December 1904 ...	Rs	3,199	3	3			
Cash in hand on 31st December 1904	,,	177	8	0			
Petty Cash balance on 31st December 1904 ...	,,	6	13	2	3,383	8	5
Total ... Rs.					20,140	14	4

Examined and found correct.
R. A. SPENCE,
Hony. Auditor.

N. C. MACLEOD,
Hony. Treasurer.

BOMBAY, 1*st January* 1905.

BOMBAY NATURAL HISTORY SOCIETY.

INVESTMENT ACCOUNT from 1*st January* 1904 *to* 31*st December* 1904.

	Rs.	a.	p.		Rs.	a.	p.
Balance of 3½ °/o Government Paper, deposited with the National Bank of India on 1st January 1904	4,800	0	0	Balance of 3½ °/o Government Paper, deposited with the National Bank of India on 31st December 1904	7,000	0	0
Purchased 3½ °/o Government Paper on 12th February 1904	1,200	0	0				
Purchased 3½ °/o Government Paper on 20th August 1904	1,000	0	0				
Rs. ...	7,000	0	0	Rs. ...	7,000	0	0

Bank's Safe Custody Receipts seen and examined by
R. A. SPENCE,
Hony. Auditor.

N. C. MACLEOD,
Hony. Treasurer.

BOMBAY, 1*st January* 1905.

MARINE LABORATORY
LIBRARY
MASS.

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